

MODERN Machine Shop

HOWARD CAMPBELL, Editor

Volume 7

JUNE, 1934

Number 1

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Published monthly by Gardner Publications, Inc., 704 Race St., Cincinnati, Ohio

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JOHN M. KRINGS, National Advertising Manager

IVER W. LEE
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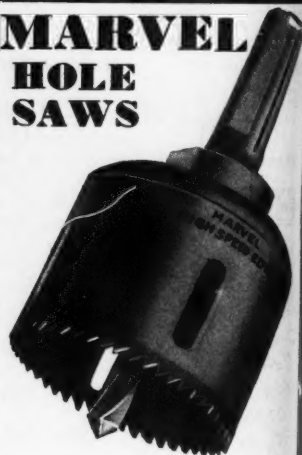
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MODERN Machine Shop

CINCINNATI, OHIO

VOL. 7, No. 1

JUNE, 1934

Building a Modern Machine *E. Engineering* *10-31-45* Tool

BY ADOLPH FOERSTER

THE economical manufacture of the modern type of machine tool presents problems similar to those encountered in other manufacturing industries. A description of some of the more interesting of these problems as they are encountered in the building of "Hydromatic" Milling Machines should be of general interest to those who supervise metal-working operations.

The readers should take into consideration the fact that the manufacture of machine tools is essentially a low production operation, and the prospect of a clear-cut production schedule is obscured by the variety of sizes and types of machines in any one category that are demanded by the trade in general.

The illustration Fig. 1 shows a plain standard

Hydromatic Milling Machine. In the Hydromatic line alone there are 36 standard types and sizes of machines, not taking into account the tremendous variety of semi-standard machines which fit the production problems of some users better than a standard machine. Approximately 60 per cent of the machines manufac-



Fig. 1—Cincinnati Plain Hydromatic Milling Machine.

tured come under the classification of semi-standard, which will indicate to some extent the problems encountered by the manufacturers.

Economical manufacture of a wide variety of machines of the same type necessitates intelligent design of the

units constitute the line of standard machines.

In tooling for the Hydromatic machines, the tool engineers departed considerably from the current practice in tooling. The drawing Fig. 2 indicates the flat surfaces to be machined on the bed. When tooling up for these beds, planing and milling and a combination operation to consist of planing and milling for the flat surfaces were considered. It was finally decided that both time and floor space could be saved by milling the surfaces complete. The machine developed for these operations is shown in Fig. 3.

The machine itself is a Hydromatic machine, the table being hydraulically driven by the same hydraulic unit that is used on the standard machine. The table travel is 14 feet. One horizontal spindle carrier is mounted on each headstock, and on the variable height rail is mounted a vertical spindle carrier. All spindle carriers are provided with power feed and rapid traverse, quick change spindle speeds, quill adjustment, hydraulic quill clamping and hydraulic clamping of the spindle carriers to the ways. The machine has adequate range to mill all sizes of Hydromatic beds.

As shown in Fig. 2, the first operation includes milling the bottom of the bed and rough milling the top of the table bearings. The narrow strip milled on the side of the bed is used as a locating strip for the second setting.

At the second setting, the bed is finish-milled complete including the angular surfaces in the dovetail for the gib bearing. The photograph shows both the template used for approximate location and the indicator setting gages for accurate location of the cutters. The spacing rods used with the indicator setting gages are

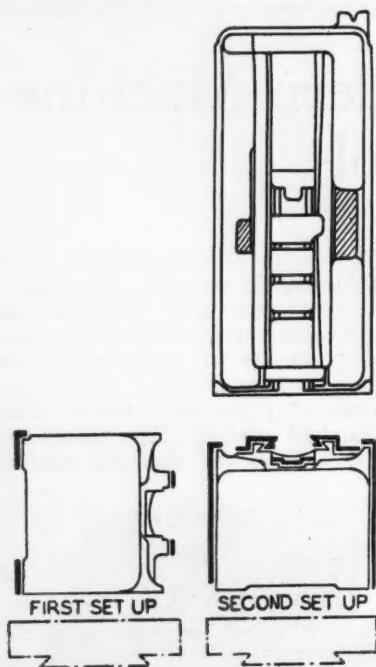


Fig. 2—Drawing showing flat surfaces to be machined.

basic units to facilitate simplified manufacture. Parts and units not common to all machines should be similar in design to facilitate tooling. Accordingly, the Hydromatic is ideally designed for unit manufacture, each machine comprising basically five units. These are the bed-table unit, the pulley or drive bracket, the headstock, the spindle carrier, and the hydraulic or feed unit. Various combinations of different sizes of these

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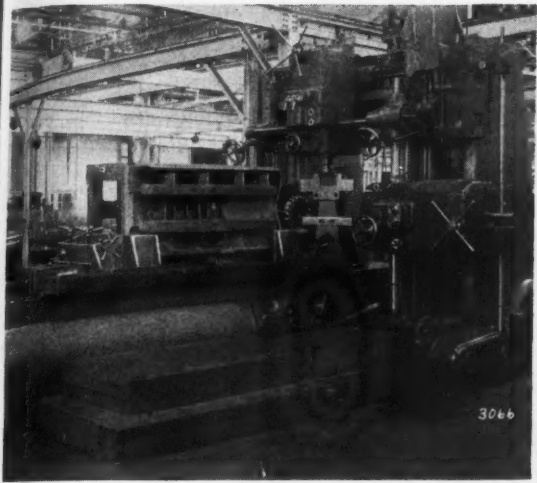


Fig. 3—Using a Hydromatic bed miller to machine the bed as indicated in Fig. 2.

Drilling, reaming and tapping of the various holes in the bed are accomplished by the use of a machine that was designed and built in this plant, and is shown in Fig. 4. This machine is designed to accomplish extremely fast positioning of the spindle with reference to jig eyes. The machine consists essentially of a

similar to the rods used on some of the finest jig-boring equipment. The

spindle carrier mounted in the stanchions in which the carrier slides ver-

use of the indicator-type setting gages insures an extreme accuracy of machining and an exact duplication of finished work.

The cutters used in the vertical spindle of the bed milling machine are held with standard quick change adapters, which, considering that eight different cutters are used in the process of milling a bed, have helped to reduce the time on this operation materially. The cutters are of high speed steel, Stellite or tungsten carbide, depending upon the application.

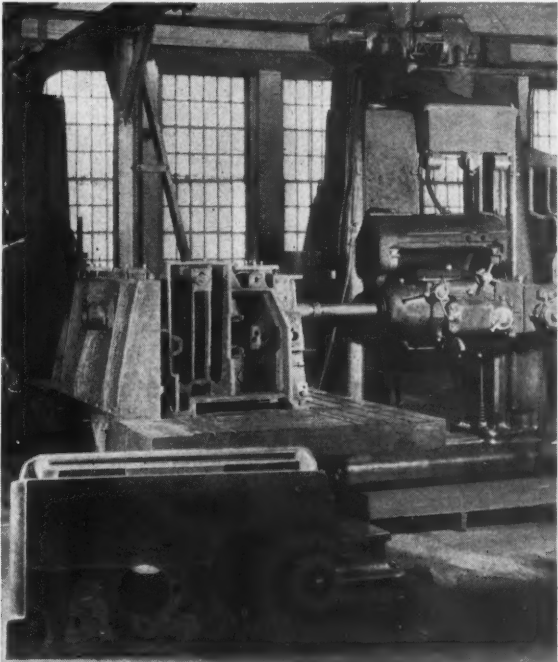


Fig. 4—Special boring machine set up to drill beds.

tically. The stanchions themselves are mounted on a slide for positioning of the carrier away from or toward the fixture. The movements of the slides are all accomplished by individual motor-driven screws controlled by the three switches mounted on the control bracket on the stanchion, where they

arrow in the illustration. The pistol grip has a trigger which, when pressed, will release the carrier clamps, after which the carrier can be rotated so that the spindle describes circles of any diameter up to 4 in. and the spindle can be positioned anywhere within the area of the 4-in. circle. Re-

lease of the trigger automatically clamps the spindle carrier rigidly in position at the jig eye.

The fixture table can be rotated through 360 degrees and the holes on four sides of the bed can be drilled, reamed, and tapped at one setting. The fixtures mounted on the fixture table are universal for all sizes of beds.

For machining the spindle carrier casting, the milling machine shown in Fig. 8 is used. This machine is similar to the machine for milling the bed casting. On the machine table is mounted two fixtures, each of which is universal for all sizes of spin-

dle carriers. The fixtures are mounted in tandem on the table, and in the first fixture the headstock bearings, including the taper gib bearings, are milled. The casting is then located in the second fixture and the bottom of the carrier and the dovetail over-arm bearing are milled, using the finish-milled headstock bearing for location. This fixture is then indexed 180

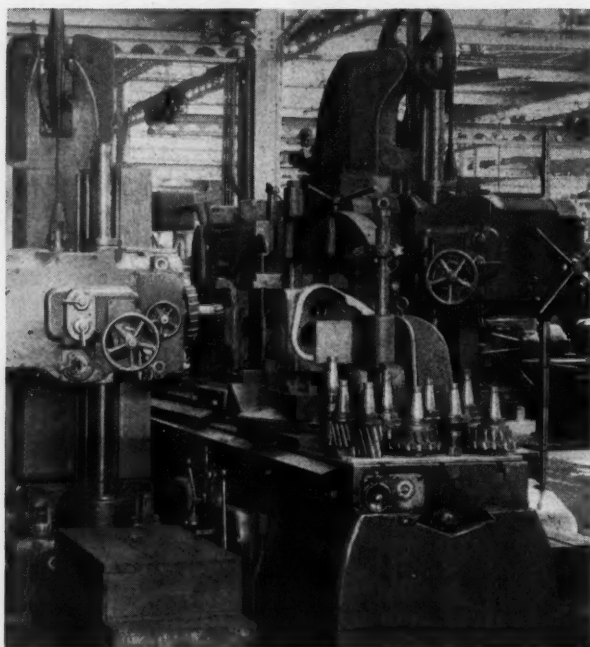


Fig. 5—Milling the spindle carriers.

can be reached conveniently by the operator.

The operator can locate the spindle approximately at the jig eye by a combination of movements of the three slides controlled by the three switches mentioned above. The accurate positioning of the spindle at the jig eye is accomplished by a novel pistol-grip control, indicated by an

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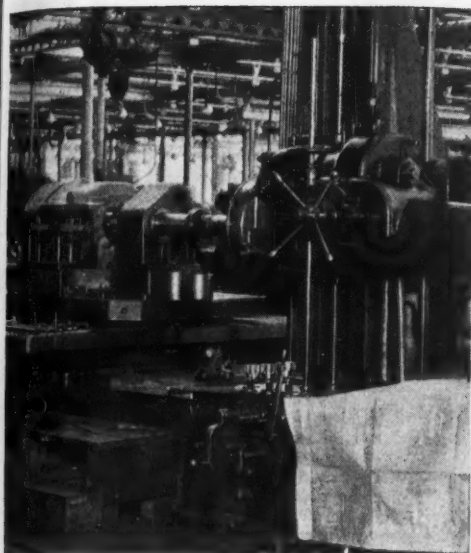


Fig. 6—Boring spindle carriers on a Giddings & Lewis horizontal boring mill.

lotting both ends of the boring bars and using a floating driver for each bar. Miscellaneous holes are drilled, reamed, tapped and faced in conventional tumble-type fixtures on a radial drill press.

A section of the department for manufacturing Hydromatic milling machines is devoted to the manufacture of small parts. One line of machines that is unusual for a machine tool shop is the battery of multiple spindle drill presses shown in Fig.

7. The battery consists of four machines joined by a track on which is carried an indexing fixture cradle. Work-holding fixtures are mounted in

degrees and the front and back faces of the carrier are finish milled, completing the milling operations.

The use of templates, indicator setting gages, and quick change adapters make possible extremely accurate work at a very satisfactory rate of production.

The main holes in the spindle carrier are bored and faced in the horizontal boring mill shown in Fig. 6. Accuracy is assured by pi-

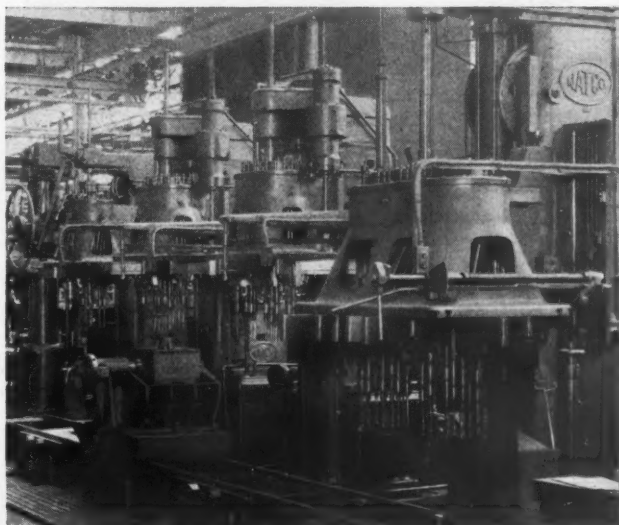
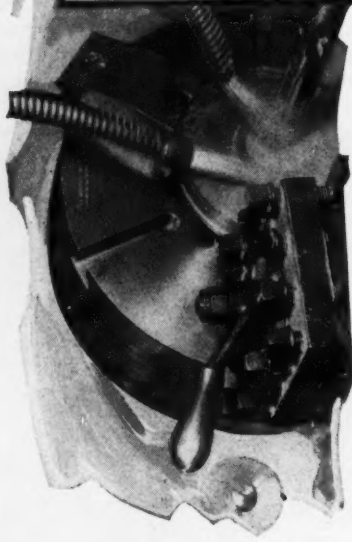


Fig. 7—A battery of Natco multiple drills pump bodies. hydraulic unit set up for drilling

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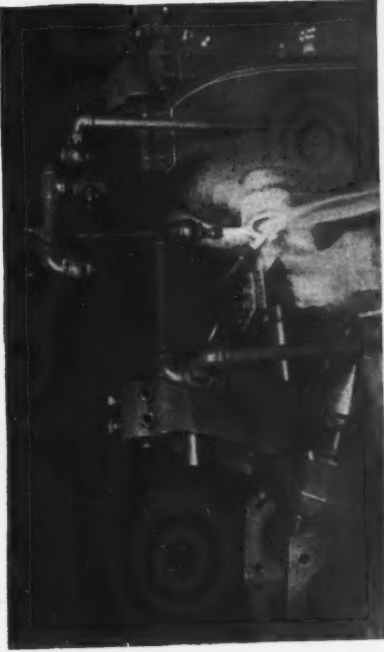
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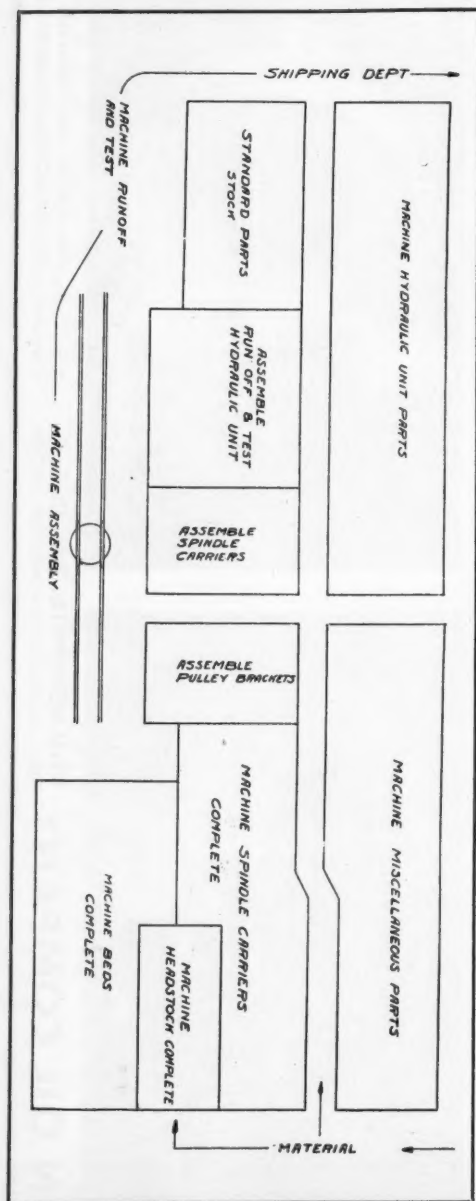


Fig. 8—Plan drawing of department layout.

the fixture cradle and the holes in the work are drilled and reamed or tapped, as required.

As the battery comprises four machines, the holes on all four sides of a piece can be machined in one fixture, simply by indexing the fixture as it is moved from one machine to another. This equipment was installed especially for drilling and inter-drilling the various holes in the hydraulic unit body. The equipment is extremely versatile and productive, and is used advantageously for a variety of parts.

The drawing Fig. 8 shows a general layout of the department for manufacturing Hydromatic milling machines. The department is a unit complete in itself for the building of the machines with the exception of the gears, shafts, and spindles. It has been found that better results can be obtained by making the gears and shafts in a separate department where all the gears and shafts for all the machines are made. Spindles are also made in a separate department.

The use of special equipment permanently tooled for operations on the Hydromatic machine components permits adequate production from an extremely small floor space. The Hydromatic department covers an area of only 16,000 sq. ft., from which approximately one complete machine every six hours is produced.

The planning of the department allows the building of machines of the various standard types and sizes as governed by the production demands with-

out interrupting the continuous flow of machine construction in the department. The department layout shows the main assembly stations where pulley brackets, spindle carriers, hydraulic units, and the other parts are assembled and tested. This is a simulation of automotive assembly methods, and the adaptation of these methods to the building of machine tools marks an important step forward in machine tool building practice.

The line assembly system is essential for the building of a wide variety of similar machines while at the same time maintaining on any machine in the line a reasonable delivery schedule without the necessity of carrying a large stock of finished machines.

The method of machine assembly in operation here combines quality workmanship with expeditious production methods. It comprises, in effect, a group of assemblers, each specializing in the assembly of a single unit, instead of a complete machine assembly. These men become expert on the assembly of the particular unit to which they are assigned, and thus the high quality of each individual unit in the machine is assured. By the same token the machine assemblers on the line become expert at mounting these units, thus again assuring that the finished machine will pass the rigid test to which each machine is submitted before it is released to the customer.

"Lubricants and Coolants for Metal Cutting"

Above is the title of a book that contains a fund of interesting and informative data regarding the various processes and operations ordinarily used in the fabricating of metal parts. The book is published by the Socony-Vacuum Corporation, 26 Broadway, New York, N. Y., and is primarily intended to educate the

reader as to the advantages in production and finish that are provided through the use of proper coolants and lubricants; however, in discussing the matter of coolants, the author includes a considerable amount of interesting information regarding the manner in which various kinds and types of tools are used.

Starting with a chapter on the Fundamentals of Cutting, the author follows with chapters on Grinding, Cold Sawing, Shaping and Planing, Turning and Boring, Drilling and Reaming, Milling and Hobbing, Threading and Tapping, and Broaching. Following this is a section on Metals and Recommendations, in which the author tells, concisely but clearly, what each of the common metals—cast iron, malleable iron, wrought iron, steel, low carbon steel, high carbon steel, alloy steel, and the various non-ferrous metals—consists of and how it should be worked. The book concludes with a table of the S. A. E. Numbers of Various Steels, and a table showing the type of coolant to use for each kind of operation and kind of metal.

A copy of the book will be sent gratis to any mechanical executive who will address his request as above.

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According to a folder that is being issued by the Stackbin Corporation, Providence, R. I., that question is being answered today in a large number of plants and shops by the use of an organized system of storage bins of standard design, built in a variety of sizes and designed so that any number can be grouped in an orderly, symmetrical manner. At the same time, each bin is self-contained and can be moved about, set on the floor or on a bench, or placed in a group, at will. If desired, section bases can be provided in which any number of bins are held together.

These storage bins, called "Stackbins", are fully described in the folder, and dimensions and prices are given. Copies free to plant executives.

Conveyors Double Forge Shop Production

BY EDWARD J. TOURNIER

THE present-day state of finance and industry makes it imperative that manufacturing costs be reduced through the adoption of time and labor-saving methods in the plant. And in a great many cases a large part of this saving can be made without the necessity of throwing out present equipment. Machines of modern design usually produce faster, better, and at less cost than machines of older vintage, it is true; in fact, there are many cases where a modern type of machine would pay for itself in the saving it would make over a period of weeks or months, but the replacement of equipment is not the only avenue through which substantial savings can be made.

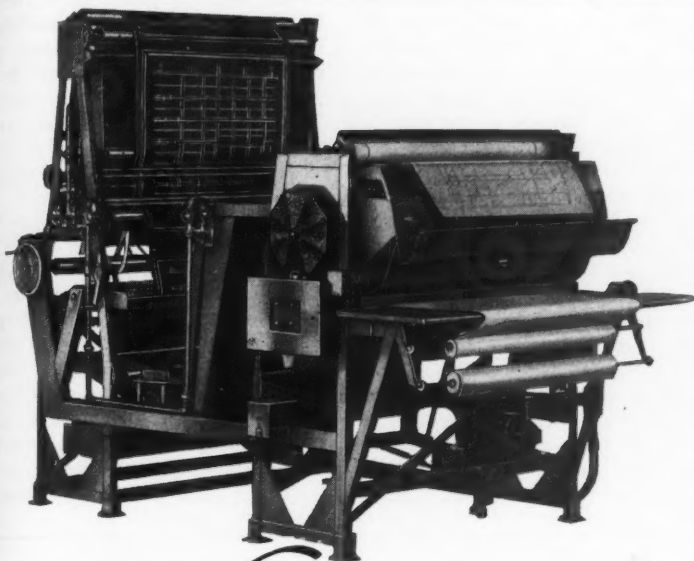
One of the most important items in the operation of a manufacturing plant, and one that too often receives but scant consideration, is the manner in which the parts and materials are moved from one operation to another. Although the subject of material-handling has been brought to the attention of industrial executives with increasing frequency of late years, it is still not uncommon to find a plant equipped with modern machinery while transporting materials by comparatively antique methods. Such a condition offers an excellent opportunity for making a saving through the introduction of conveyors or other efficient method of material-handling and there have been cases where the installation of a conveyor has transformed a series

of intermittent operations into a continuous process.

An example of such a modification is found in the forge shop of the Packard Motor Car Co., Detroit, Michigan, where forgings for front axles, steering knuckles, and other small parts are produced. At the plant the movement of material through two heat treating furnaces was already being handled by automatic machinery, but the transfer of the materials from one furnace to another was handled manually. The result was that production was slowed down to the speed at which the materials could be moved between furnaces, and very often the congestion became so great as to stop production entirely until the parts could be moved away.

To relieve this situation a conveyor system was installed, with the result that the furnaces could be operated at full load and in a short time production was doubled. The furnaces are placed in line so that, if two heats are required, parts may be passed from one furnace to the other. If only one heat is needed, the second furnace may be by-passed. The forgings are discharged at a point between the furnaces, whether to be by-passed or to be sent forward for additional treatment. In the latter case they pass through the cooling tank; if only one heat is required, they do not.

Essentially the system consists of a double strand chain conveyor at each end of the process, a cooling



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tank and conveyor between furnaces, and a single strand chain conveyor connecting the two end conveyors. The two double-strand conveyors are used with a series of heavy heat-resisting alloy pallets or grates to carry the forgings. These pallets are fitted with round lugs which project from each corner. The lugs engage attachments on the chains by which the grates are pushed when lying flat on a curved steel track.

When the pallets have completed the travel to the end of the second furnace, they are turned through an arc of 90 degrees while still lying flat. After being turned horizontally, they are lifted over so that they fall on edge in a trough containing the connecting link conveyor. The purpose of the latter is to return the pallets

to the starting point. Here the grates are several feet lower than the first end conveyor, and as they are on edge, the pallets must be not only elevated, but must be brought to horizontal position, then revolve again through an arc of 90 degrees, as at the discharge end but in the reverse direction.

In the event that only one heat treatment is needed, the grates are taken out at the end of the first furnace and sent back to the loading point by means of the connecting link conveyor. After the grates have made the horizontal turn at the loading end, they slide over an inclined plate to the floor. From this point they are taken to the loading end of the furnace for loading by hand as shown in Fig. 1.

The loaded pallets are handled by

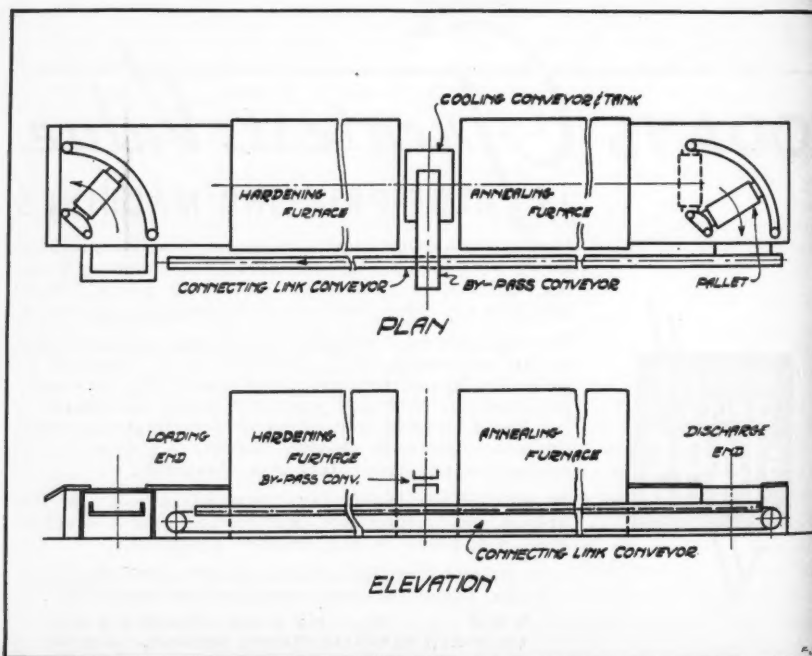


Fig. 1—Diagram showing arrangement of conveyors for handling forgings continuously.

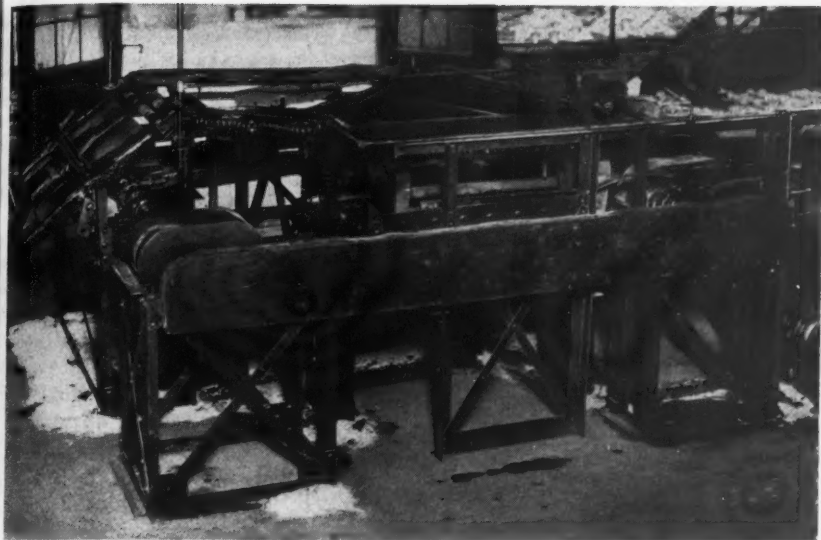


Fig. 2—View at loading end of furnace, showing turntable conveyor handling pallets. At the left is the lifting mechanism; at the right, the pallets being loaded with forgings.

a special mechanism which is part of the furnaces; the external conveyor system is exclusively for the purpose of facilitating transit of the pallets from one end of the process to the other with a minimum of hand labor.

Since the operation of this conveyor system is entirely automatic, the various motions must be accurately timed and synchronized. When a grate is brought to the feed end by the connecting link conveyor, the attachments on two vertical chains

must be in position to engage the pallet lugs. These same lugs are contacted by fittings on a horizontal turntable chain after the pallets have been lifted. Finally the grates are turned in the horizontal plane so that they are delivered in the right position at the loading end.

The timing of the various operations, and the synchronizing of the conveyor drives, include a combination of variable speed transmissions interlocked electrically with the furnace temperature control.

Horsburgh & Scott Industrial Gears and Speed Reducers. General Catalog No. 34, issued by The Horsburgh & Scott Co., 5116 Hamilton Ave., Cleveland, Ohio, contains 448 pages of information that should be of prime value to any designing engineer, chief engineer, or buyer of gears or power transmission machinery. The first part of the book is devoted to a discussion of tooth forms, horsepower capacity of gears, horsepower ratings and allowable tooth loads for different kinds

of gears and of different materials, with 31 pages of tables. This is followed by several pages of suggestions for installation and maintenance of gearing. The text includes tables for everything that any engineer would need in laying out or ordering gearing of any kind, tables of dimensions of hobs and rules for ordering. A copy of the book is available to any mechanical engineer or plant executive upon request.

A Crib Man Speaks

By REX K. ALLEN

"BELIEVE IT OR NOT" as Ripley would say, the tool crib in the average small machine shop—and in some of the larger ones, too, for that matter—can be directly responsible for many losses both in small tools and spoiled work, which easily translates into dollars and cents.

It must be admitted that each minute a workman is kept waiting while the crib man paws through a series of drawers in which reposes the accumulation of ages as well as the tools wanted is costing somebody money, and it might as well be you. When this condition is multiplied by a number of workmen standing idle and gossiping while awaiting their turn at the window, and we realize that each one of them visits the crib many times a day, the losses begin to assume real proportions.

To begin with, the crib in the average small shop is in charge of some inexperienced youngster or someone past the age of productive ability, and very often—too often in fact—past the age of productive thinking. And, contrary to general opinion, a general understanding of what it's all about and the ability to think and act quickly are absolutely essential

Inefficient management of the tool crib has been responsible for more waste — both in time and tools — than any other item of machine shop operation. In this article a wide-awake tool crib attendant makes a few suggestions.

to successful crib operation. Often a crabbed, sour-faced attendant with a single-track mind costs his employer a considerable amount of money while basking in the fond belief he is really saving it. I have in mind a tool room in a plant where I once worked, and

which is a good example of the type of crib I am talking about.

In this particular crib the attendant was frankly overworked. Too much was expected and required of him, although a large part of his work was caused by lack of the proper understanding of crib lay-out

and operation. The crib was a combination tool room, stock room and cutting room.

The steel was delivered at the rear entrance, several hundred feet from the point of the cutting saw, which was in the crib. No roustabouts or laborers were employed in the plant, in the interests of economy; thus the crib man was required to carry the steel to the saw, deserting his post while so doing. When the bars were too heavy to be carried by one man, help was obtained from anyone who would lend a hand—often as not a bench man or machine operator.

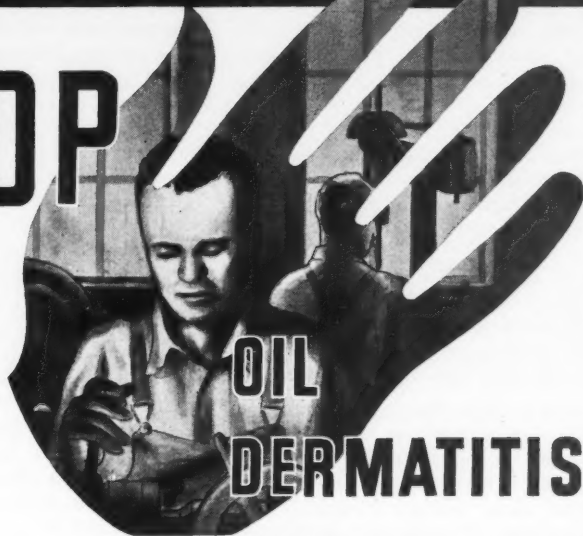
The cold rolled steel was covered by the customary protective coating

(Illustrations courtesy Lyon Metal Products, Aurora, Ill.)

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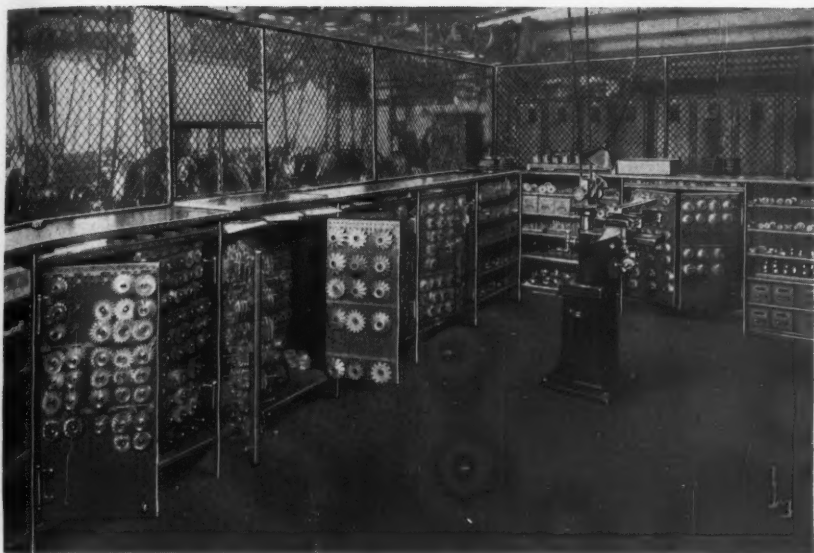
of grease, consequently particles of grit, sand and dirt adhered to it, and no one bothered to remove this until it was finally cut and delivered to the bench man. If some one removed it, here was an expensive man stopping actual production to do the work a forty-cent man should have been doing; if it was left on, it did no particular good to the edges of cutting tools. At the crib it was piled haphazardly into racks without regard for size or uniformity and the possibility that it might fall off and injure workmen was always present. It was necessary for the crib man to spend a lot of time looking for the desired size while workmen waited for their tools. This was neither good business nor good sense.

The layout of the crib itself was pitiful, and in this connection I want to say a word to the layout man. Before laying out a tool crib, I would recommend a trip to the local printing office and the thorough inspection of a type case, noting especially the arrangement of characters as regards their use. The layout of type cases didn't just happen; it is the result of careful study and the placing of the characters most used nearest at hand. Now could anything be more sensible? And yet, in this crib, the articles used most were placed farthest from the window, necessitating the attendant walking hundreds of extra yards each day while the workmen waited for their tools or supplies. To illustrate: the small tools were kept in a series of drawers. The drawer nearest the window contained the attendant's personal belongings; the one directly below it, taper pin reamers—used about once a week; next, letter size drills, seldom used in this particular shop; then keys for Allen head cap screws, which might at most be called for

twice a day. In direct contrast, the small fractional and number size drills up to one-half inch were placed in a cabinet of the rotary type about half the crib-length from the window. Large sizes of drills were comparatively handy, but seldom used; while the taps and reamers most used were kept in drawers under the case of small drills—and called for by everyone. Rolls of emery cloth were at the far end of the crib, and the crib man tore off what he thought to be the right amount for each man.

Precision tools were at the far end of the thirty-foot cage, larger tools were placed anywhere, with no regard to frequency of demand. Cutting oil and machine oil were kept in gallon containers, and the attendant filled oil cans for the waiting men; the main supply was in the basement in drums. From this, one can easily visualize the countless unnecessary steps taken in a day by the attendant, and, what is more important, the lost motion and the possibility of a jam at the window. Actually it was no common sight to see a dozen men lined up awaiting their turn.

The plant used a great many Allen set screws, and the crib man kept these in their original containers on a series of poorly built shelves. The consequence was that identifying marks were soon so smudged with grease on the box labels as to be unreadable and the boxes themselves piled one atop the other with no semblance of order. When surplus screws were returned to the crib it was no easy task to place them in their proper receptacles; generally they were dumped into the one nearest at hand. Dowel pins, also extensively used, were handled in the same manner. The net result was that when a workman asked for any particular size, he might receive anything but



This toolerib, in the plant of the Barber-Colman Company, Rockford, Illinois, is ideally arranged for the handling of various kinds of cutters.

the size requested. All of which meant wasted time and unnecessary trips for the crib man and loss of productive time by the workmen.

Another unhealthy condition prevailed here, for which the attendant was not wholly responsible. In use, identifying size marks were worn from drills, reamers and like small tools. The overworked attendant didn't want to take time to check them and put them into their proper bin, so he "guessed" at the size and as often as not guessed wrong. The result of this was that machine men, after once drilling a hole too large for tapping or reaming and so spoiling a part, took no chances; instead they proceeded to "mike" their tools while the attendant and other men waited. If it happened to be the wrong size, another trip to the bin was necessary for the correct one.

If possible, the crib man should

stamp the sizes in such a way that the characters cannot be removed. Of course such markings are impossible on small drills and the like, but there can be no excuse for their absence on sizes larger than quarter-inch. And at least he should gauge up the smaller tools and place them in their proper bins or racks. It would save much time and many steps.

The system of checks for tools taken from the crib was the standing joke of the shop. As no means was provided for the accurate placing of checks in relation to tools taken out, many were lost. The attendant merely laid the check near where the tool was kept, and sometimes a dozen checks would be put in one pile for a dozen different tools. It was impossible to ascertain what workman had any particular tool. Some of them had all their checks in the crib and no tools in their possession, so dis-

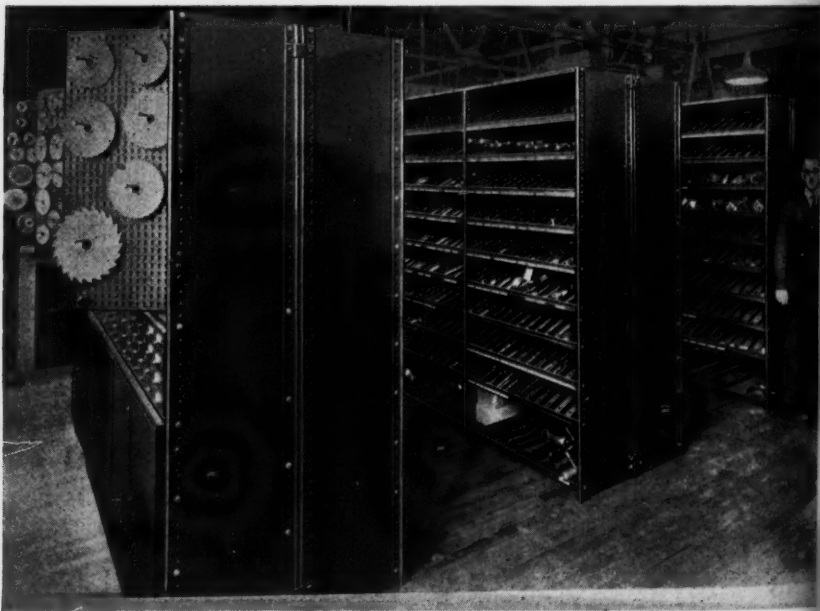
pensed with the formality entirely. Others claimed the same thing and forgot to return tools thus given out. Some, no doubt the possessors of a trace of conscience, traded carbon drills for the high speed variety taken from the crib. With proper identifying marks an alert attendant would have caught this, and the practice would have died out in a short time. Instead, the small drill bins were eventually filled with short, broken carbon drills—worthless for use.

I mentioned earlier in this article that intelligence was essential to the proper operation of a crib. This is true to a greater extent than many realize. Let me illustrate: A workman asks for a half-inch reamer and a twenty-seven sixty-fourths drill. Maybe he knows what he's talking about; maybe not. The chances are that he's

thinking of the big one that got away or wondering what the wife will have for dinner. At any rate, an alert crib man sees no connection between the two sizes and makes inquiry, finding that what the man really wanted was a half-inch tap and a tap drill. The error has been detected and the possibility of spoiled work lessened. Don't think it doesn't happen, it has; not once but many times.

And so take a tip from a former tool crib attendant. Don't sit in your office chair and wonder how in hell the men manage to use up so many small tools. See that your crib is planned and constructed with an eye to utmost efficiency. Don't expect to operate the crib satisfactorily with a man who has been a failure at everything else; a good man will resent this

(Continued on Page 52)



Arrangement of small tools in the crib at the Boeing Airplane Company's plant, Seattle, Wash. The sections are of steel, with adjustable shelves and partitions.

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Budgeting Plant Expenditures

By J. J. BERLINER

Senior Member National Accounting Systems

THE maintenance of a plant in condition for efficient operation involves a series of more or less constant expenditures. These expenditures may be divided into four classifications, as follows:

(1) **Repairs.** This classification includes the work that is done on existing equipment to keep it in condition so that it will function properly.

(2) **Replacements.** This classification covers the expense of equipment that is purchased or made to replace similar equipment that is obsolete or worn out.

(3) **Improvements.** This item includes expenditures for new patents or improvements to equipment which will lengthen the life of the equipment or increase its capacity or efficiency.

(4) **Additions.** Under this heading come expenditures for new equipment caused by expansion of the business or increase in the volume of business.

In order to maintain an effective control over expenditures for plant and equipment, a proper analysis must be made of the expenditures to determine their classification and a record should be kept to show the effect of such expenditures upon the financial condition of the business. By following this record closely it will be possible to provide a well-equipped and efficient plant and at the same time prevent the expenditure of more than is necessary to secure this result.

Accounting

Repairs. From the standpoint of accounting, repairs are usually con-

sidered as current expense to be charged against the income of the period in which they occur. However, if for any reason the cost of repairs fluctuates and it is desired to distribute the repair expenses evenly, this may be done by estimating the average cost of repairs on the basis of past experience and future estimates and setting up a reserve for repairs.

Under this method there will be charged to expense and credited to reserve for repairs at the end of each period an amount equal to the estimated average cost of repairs. As the repairs take place, they are charged to the reserve for repairs. Since the credit to the reserve account is not made until the end of the period, and the repairs are charged to it during that time, the account may show a debit balance during the period but this balance will be adjusted by the credit entry before the financial statements are compiled.

Replacements. The cost of replacements is not an expense of the period in which the replacement takes place, but of all the periods during which the equipment that is replaced has been used. Thus if a machine cost \$2,000 in 1932 and is replaced in 1937 by another machine costing the same amount, the cost should be spread over the five years. If the scrap value of the old machine is \$200, the five years must be charged with \$1800, divided evenly, or \$360 for each year.

Since the actual expenditure for a piece of equipment is usually spent at one time, and not during each year of

Fig. 1—Form for Plant and Equipment Budget.

Fig. 1—Form for Plant and Equipment Budget.											
Group	OLD EQUIPMENT			NEW EQUIPMENT				Total Depreciation	Total Repairs	Value of Total Equipment at End of Period	
	Amount at Beginning of Period	Estimated Depreciated	Estimated Repairs	New Equipment Required	When Needed	Estimated Depreciation	Estimated Repairs				
1	2	3	4	5	6	7	8	9	10	11	
					</						

Fig. 2—Form for Monthly Report on Appropriations.

Name of Appropriation	No.	Period	Percent of Completion	Original Amount	Additions	Deductions	Final Amount	Cash Disbursed	Accounts Payable	Undisbursed Balance	Contract for Labor and Supplies	Balance Available for Future Contracts
1	2	3	4	5	6	7	8	9	10	11	12	13

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its use, it is customary to credit the estimated depreciation to a "Reserve for Depreciation" account and to debit an expense account for the same amount. When an asset is sold or discarded, it is charged against the reserve account. By this means the cost of the equipment can be charged against the income of the various periods which benefit from its use.

Improvements. When improvements are made, it is obvious that the benefits to be derived will be spread over future periods, either through the increased efficiency of the equipment or by reason of its longer life, consequently such future periods should bear their respective shares of the cost. Hence improvements are charged to asset accounts and are not reflected in the expense accounts of the periods in which they are incurred.

Additions. As additions, like improvements, are expected to benefit future periods, their costs are distributed over the periods during which they are used. This is done by means of the periodical depreciation charge; hence additions are a capital, and not a revenue, charge.

Summarizing the foregoing, plant and equipment expenditures can be divided into two main groups: (1) Those expenditures which are made in order to maintain present equipment by means of repairs and replacements, and (2) those which represent additions to the assets of the business. The first should be included in periodical expense accounts, and the second should be charged to the asset account.

To exercise effective control over disbursements for plant and equipment, the following factors are necessary. First, data must be available to show results of past operations and to serve as a basis of future plans. After all the available data have been considered, the plans that have been formulated must be expressed in

workable form by means of a budget on plant and equipment. Sometimes two budgets are used; one on maintenance costs and one on the cost of improvements and additions. However, the requirements for these items are sufficiently similar to make their joint consideration possible.

After the budget has been completed, it is necessary to have records and reports prepared which will make possible the control of the expenditures and the enforcement of the budget plans. The data required to serve as a basis for the control of plant and equipment expenditures may be gathered from the following four sources: (1) The accounting and statistical records with reference to past experience; (2) Calculations based on predetermined factors; (3) The consideration of future plans; and (4) The investigation and study of experts.

The first step consists in making proper classification of the plant and equipment, then the expenditures for plant and equipment must be accurately estimated. In a manufacturing business, for instance, plant and equipment expenditures will vary with the production program. If the production schedules are to be increased, it will be necessary to do one or both of two things; either secure additional equipment or use the present equipment more extensively. In either case, additional expenditures will be made. If present equipment is to be used more intensively, maintenance costs will be increased and an estimate of this increase must be made accordingly.

The basis for all of these costs and charges is the plant ledger, which carries an account for each unit of plant equipment. The plant ledger serves as a subsidiary record to the controlling account or accounts with plant and equipment kept on the main

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ledger. The plant ledger is usually kept on cards or loose-leaf sheets, each card or sheet providing a record of one unit of equipment, and each account should show the original cost of the equipment and the date of purchase, the amount of depreciation accrued on the equipment to date, the amount of repairs on the unit to date, and the present book value of the unit.

The repairs entered on the plant ledger account do not affect the value of the equipment since they are treated as an expense and are never added to the asset. It is, however, useful to have them entered on the plant ledger account for memoranda purposes, so that in making future estimates it will be possible to obtain information regarding the past cost of repairs, not only in total but also by departments and by units.

As equipment wears out, provision must be made for replacement. This provision is accomplished by charging a certain amount to the expenses of each budget period and crediting a like amount to a reserve for depreciation. In the calculation of the depreciation charge, the original cost of the asset, its anticipated life, and its estimated scrap value must be considered. By subtracting the scrap value of the asset from its original cost, it is possible to determine the cost of the use of the asset during its period of life. This cost is usually distributed over the period of the life of the unit in such a way that each budget is charged with an equitable share.

After the maintenance costs of past periods, as shown by the accounting and statistical records, have been obtained, it is necessary to determine the effect of future plans on these costs. At this point various comparisons should be made. Some items of maintenance cost will vary in pro-

portion to production volume. To estimate these items, it is necessary to determine the rates of volume of production to these costs during the period. By applying this ratio to the estimated volume of production for the current period, an estimate for the period can be obtained.

Some items of maintenance will vary more nearly in accordance with the floor space used than with the production volume. Thus the ratio of floor space used in the past period to these items of maintenance expense during the same periods will be obtained, and the ratio applied to the estimated floor space of the current period. Other items of maintenance costs may vary in proportion to the number of units of equipment used and their amounts will be correspondingly increased.

A periodical inventory or appraisal of plant equipment should be made and used as a means of checking the plant ledger and also as a basis for budgetary plans. By this means, inaccuracies in depreciation estimates and inadequate repairs can be discovered and corrected. It is also possible that too liberal depreciation may be allowed or too much allowance for repairs, and such an appraisal will disclose these facts.

In any well-regulated plant the staff should include a plant engineer who is responsible for the proper setting in connection to power, and efficient operation of all plant equipment. He more than any other person in the organization, should be well posted at all times regarding the most modern methods of factory operation and the latest in equipment and tools. He should be responsible for the arrangement of equipment—commonly known as “plant layout”—in which he should work in harmony with the executive in charge of production.

The plant engineer must be kept

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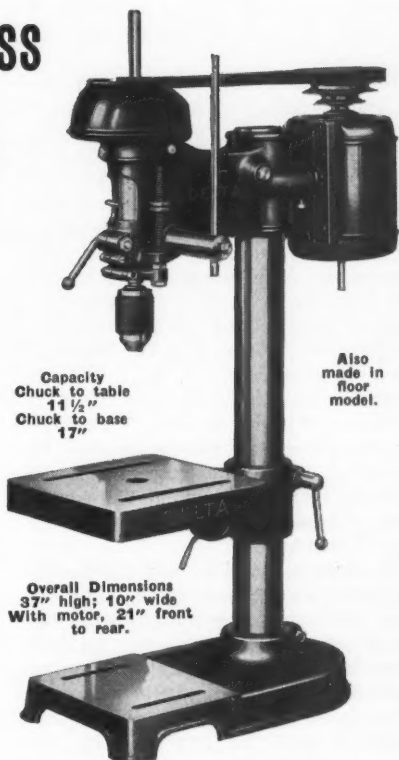
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informed as regards any proposed increases in production schedules, so that he can plan for plant equipment accordingly. If production increases are planned beyond the present capacity of the equipment, the plant engineer will make up an estimate of the cost of the additional required equipment.

No standard form for the plant equipment budget can be presented here. The sample Form 1 indicates, however, the type of information that such a form should contain. The information required for columns 4 and 8 will be supplied by the master mechanic's office or works engineering department. The same applies to the data for column 5. If new equipment is to be supplied by outside vendors, the necessary data can be obtained from the purchasing agent. Column 6 can be used to indicate when new equipment will be needed. Considering the dates, as nearly as can be estimated, the purchasing agent will state the terms upon which the equipment will be purchased and show the date of payment.

The budget for plant and equipment consists of an estimate of the expenditures necessary for maintaining the present equipment and securing and maintaining the additional equipment demanded by the budget program. After such a budget has been prepared, it must be approved by the proper authority.

The approval of the budget consists principally in the making of the necessary appropriations to cover the cost of the various items included therein. The authority to grant expenditures under each appropriation is customarily delegated to an official who exercises full control and disburses the funds only upon requisition. When repairs or additions to equipment are desired by any department, the head of that department

submits a requisition accompanied by an estimate of the cost of repairs or additions. If the equipment is to be purchased from outside vendors, it is an easy matter to obtain figures as to the purchase cost.

Estimates as to costs of repairs or construction can be made in two ways. If the business maintains an engineering department, this department can be asked to make the estimate. If the estimate cannot be obtained from engineers, it can be made by the cost accounting department on the basis of statistics obtained from previous records of costs for similar work. If cooperation between the engineering and accounting departments can be obtained, more accurate estimates will be obtained.

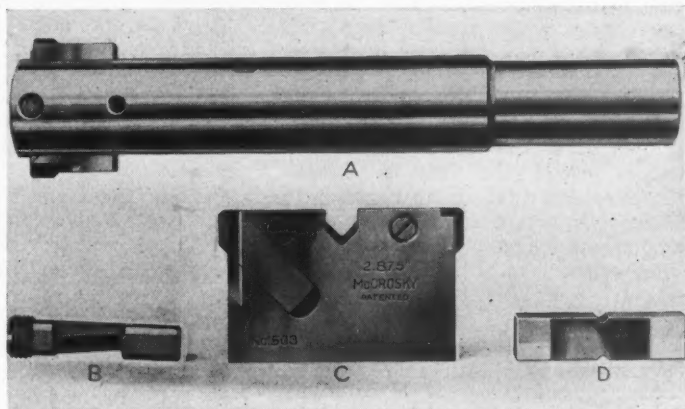
Careful records should be kept of the costs of all construction. After a requisition has been approved it is given a number for purposes of identification and record, and this same number appears on the construction order authorizing the job. An account is opened on the cost records, and all costs incurred on this job are charged to this account. When the construction is completed, the account is closed and a report is made to the supervising executive showing the estimated cost and actual cost. If there is any considerable variance, either the estimate was inaccurate or the actual cost in excessive.

Every attempt should be made to obtain accurate costs on construction or repair orders, as these cost figures will aid in exercising effective control over costs of future work. Without accurate cost reports, it is impossible to judge the efficiency with which the work is done or to estimate accurately on future work. To aid in exercising the proper control, it is necessary to have periodical reports which will make possible a comparison between the amounts appropriated for

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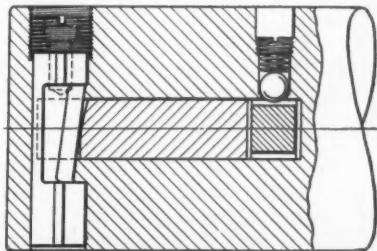
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Cross-Section of Bar, Block, Key and Wedge

each class of expenditures and the amounts actually expended. Such a report is shown in Fig. 2.

This report is of service not only to the executive who controls the purchases for construction of plant and equipment, but also to the financial executive. To the former the report shows the amount available for future purchases or construction, and to the latter it shows the amount which he must plan to finance. The tenth column gives the treasurer information of special value since it indicates the payments that are to be made in the near future. Column 13 shows the amount which may be diverted to some other purpose in case of financial stringency. If the executive committee receives this report each month, it can exercise an effective control over all disbursements.

The following is a brief summary of procedure for budget control of plant and equipment:

(1) Requirements For Control of Plant and Equipment.

(a) A proper analysis of plant and equipment expenditures to determine their classification and a record of them which will show correctly their effect on the financial condition of the business.

(b) A proper control of the amounts expended for plant and equipment to the end that sufficient will be expended to provide a well-equipped and efficient plant and at the same time will prevent the expenditure of more than is necessary to secure this result.

(2) Control of the Expenditures.

(a) That data be available which shall show results of past operations and serve as a basis of future plans.

(b) That plans be formulated upon the basis of this data and be expressed in workable form by means of a plant and equipment budget.

(c) That records be maintained and reports made which make possible the

enforcement of the budget as formulated.

(3) Data Required as a Basis of Control.

(a) Data obtained from the accounting and statistical records with reference to past experience.

(b) Data obtained by mathematical calculations based on predetermined factors.

(c) Data formulated by consideration of future plans.

(b) Data obtained from a study by experts.

(4) The Plant and Equipment Budget is Intended to Show—

(a) Anticipated repairs and estimated depreciation on the present plant and equipment.

(b) The estimated cost of new equipment including (1) cost of factory equipment and (2) cost of equipment for administrative and merchandising units.

(c) Anticipated repairs and estimated depreciation on the proposed equipment.

(5) Records and Reports for Control of Plant and Equipment Include

(a) Requisitions for all purchases of equipment and for all construction of equipment or repairs.

(b) Estimates of cost of purchases for construction which accompany the requisition.

(c) Records of the cost of all construction or repair work performed by the concern.

(d) Reports showing a comparison of estimates and costs.

(e) Reports showing a comparison of expenditures with budget allocations.

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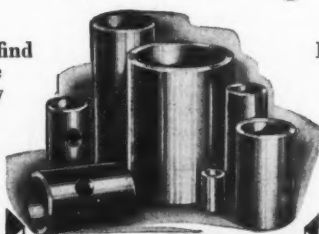
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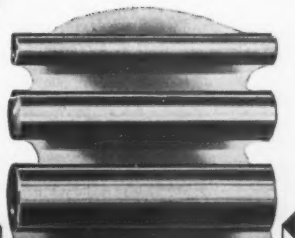
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Cutting Long Cams On A Shaper

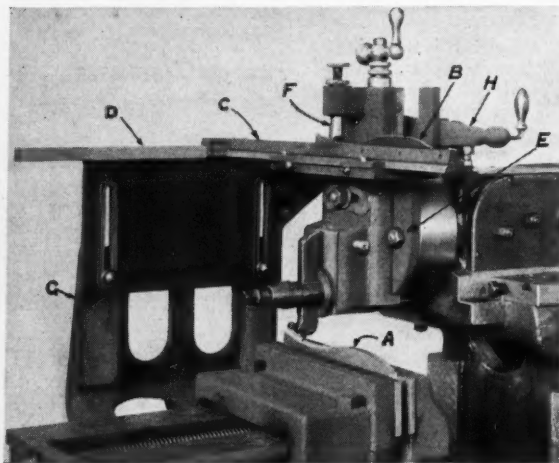
BY GRANT VILLON

WHEN a shop frequently has a number of the long so-called slide type of cams to make for new installations or replacements, it pays to rig up some kind of a fixture so

or one made of heavy sheet metal that is stiff enough to stand the pressure of the follower.

In the illustration, a completely finished cam is shown at A, and the pattern, or master cam, at B. Of course cams machined by this method must be smoothed up with files or scrapers and cannot be machined as smooth as the one shown in the vise

However, with fine feed, a well ground tool, and a little care, very little need be left for hand work. The master cam is held in a channel of a cross-slide C by means of set screws, and the length of cam that may be machined is only limited by the total length of the shaper cross-feed. The end of the slide C fits over and rides on the way D, and it has the same reciprocating movement as the shaper ram, since the ways in which the slide works are bolted solidly to the shaper head, as shown



A Shaper Fitted for Machining Long Cams

that they may be machined quickly and accurately. The shaper fixture illustrated covers practically every requirement for making a variety of such cams, either from the manufacturing or the job shop viewpoint. With this fixture either one or as many as the shaper vise will hold, may be machined at one setting. The master cam may be a finished cam

at E. This construction makes it possible for the form follower F to constantly contact the master cam as the ram of the shaper works and as the cam being machined is fed along under the cutting tool. Since the bracket G which supports the guiding way D is bolted to the end of the shaper table, it will be plain that the cross-movements of the

master cam and the work in the shaper vise are exactly alike. To keep the follower in contact with the master cam, the vertical screw feed is released and the hand lever H is used. If it were desired to make the operation entirely automatic, this hand lever could easily be replaced by a weighted lever or a spring. The spring would keep the follower in full contact with the master cam as the power cross-feed carried the work along under the cutting tool. On single jobs, it is more desirable to have the operator guide the tool, since the cuts vary considerably in depth unless the cam to be machined is roughed out close to form before being placed in the shaper vise.

Grinding Bandsaw Pulleys

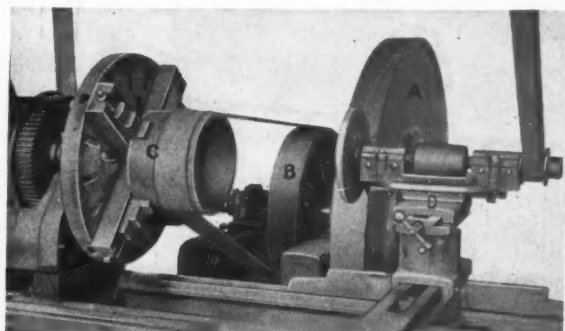
BY AVERY E. GRANVILLE

BANDSAW pulleys, owing to their large diameter, are rather difficult to grind when worn from use, unless a special grinding machine is employed to grind them on their own frame. This, of course, is the better way whenever it is possible, but often it isn't.

A general machine shop in a district well dotted with sawmills of various kinds frequently has to replace worn pulley shafts and true up the pulleys which are brought in to them by the mill men. In most shops of this kind, it is the usual practice to make use of equipment on hand for doing any kind of job until the amount of work or their own capital enables them to buy regular machines for the purpose. The lathe is a ne-

cessity, of course, and at least one up-to-date lathe is usually found in each repair shop of any size. Old or worn-out lathes are used as foundations on which to build other machines capable of being used for many things. In the present case, an old lathe is used to grind the bandsaw pulleys when fitted as shown.

A bandsaw pulley A, mounted on its own shaft, runs in babbitted bearings bolted to a frame made of heavy timbers and set back of the lathe bed. A split wooden pulley B is placed on



Grinding a bandsaw pulley

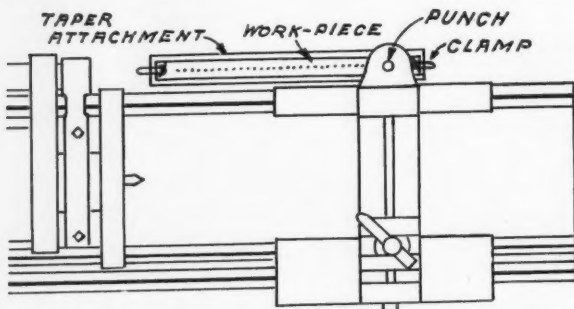
the pulley shaft and belted to a turned cast iron drum C, held in the lathe chuck. The grinding wheel fixture D was made from an old buzzsaw mounting and the spindle is driven from an overhead pulley on the main shaft. Feeding of the grinding wheel to or from the work is done with the toolslide feedscrew. The lathe carriage feed moves the grinding wheel across the face of the pulley being ground. As the pulley is ground straight across and not crowned, no other movement is needed. However, if a crowning job is required for some other pulley, it may be obtained by setting the toolslide at a slight angle and grinding only to the center of the pulley face, then resetting the tool-

slide at the opposite angle and finishing the other half of the face. It will be plain from this that pulleys of almost any kind or diameter may be ground on this machine, and when the attachments are not needed they may be taken off and the lathe used for other work.

Using a Lathe with Taper Attachment for Laying Out

By H. A. EVARTS

AMONG the jobs that came to me recently was one which consisted



Drawing showing how lathe with taper attachment was adapted for laying out 300 holes.

of drilling 300 holes, each 0.062 in. in diameter, in a straight line in a strip of steel $\frac{1}{4}$ in. thick, $1\frac{1}{4}$ in. wide, and 30 in. long. The allowance between holes was plus or minus 0.0015 in., and the total allowance was the same. Realizing that any job can be done more accurately by machine than it can be done by hand, I conceived the idea of utilizing the taper attachment of a lathe for marking off the hole centers. The results justified my idea.

I set the taper attachment parallel with the lathe-bed, then removed the bolt that holds the taper bar to the cross-slide of the lathe. As the bolt

hole was concentric and smooth, it was an easy matter to make a prick punch that would be a close, sliding fit in the bolt hole. The punch was given a fine point.

The next move was to clamp the strip of stock to the taper attachment. My idea was to use the mechanism of the lathe in the setting of the punch for each hole, feeding the carriage toward the headstock by means of the leadscrew. The square thread on the

leadscrew was 8 Pitch; thus— or —
 $\frac{80}{125} = \frac{16}{25}$

of a turn of the leadscrew was required to move the punch from one hole center to the next.

At this point it became necessary to find means for revolving the lead-screw the exact amount required, which could best be done by means of an index plate attached to the end of the screw. I found a round plate of about 10 in. diameter in the scrap pile, bored and splined the plate to fit the screw, and located

25 lines on the edge of the plate. A milling machine index head was used to space the lines evenly. After mounting the plate on the leadscrew, an indicator finger was clamped to the lathe-bed and bent so that it would make close contact with the index plate. To avoid the possibility of error in counting the spaces, I made a band of thin sheet metal and cut it just long enough so that it would cover 16 of the 25 spaces on the edge of the plate, shifting the band each time so that the ends of the band would indicate the start and finish of the indexing.

With the apron nut engaged with the leadscrew, the punch was set for

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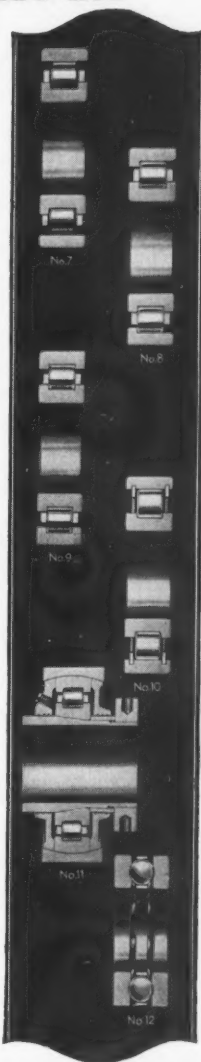
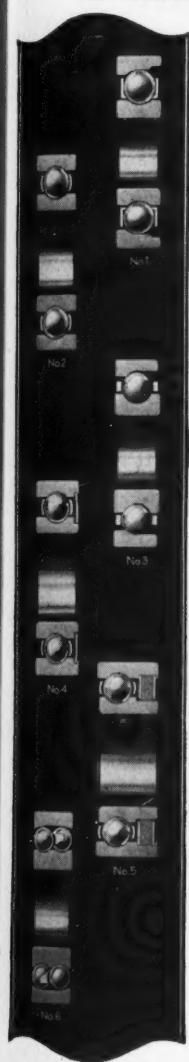
8—One-lipped cylindrical roller bearing.

9—Two-lipped cylindrical roller bearing.

10—Full type (retaining ring) cylindrical roller bearing.

11—Self-aligning adapter type cylindrical roller bearing with grease-retaining, dust- and moisture-excluding side plates.

12—Ball thrust bearing.



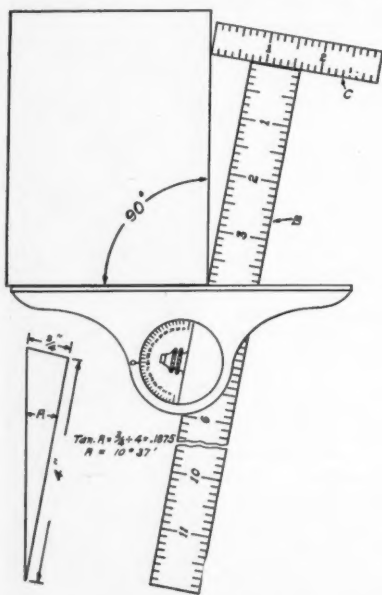
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the first hole and a punch-mark was made by striking the punch lightly with a hammer. The punch was then lifted, the leadscrew was revolved so as to feed the carriage the required 0.080 in., and the operation was repeated. The holes were drilled in a light drill press, and all dimensions were practically perfect.

Finding Angle Dimensions with a Protractor

BY EMIL GERHART

WHEN extreme accuracy is not required, all dimensions of a right angle triangle can be found by



Drawing showing use of a protractor in finding angle dimensions.

the use of an ordinary machinist's protractor. This method can be used by those who are not familiar with

trigonometry, and in any case will prove both quick and accurate enough for a large variety of work. The protractor must be used in connection with a sharp corner, such as the corner of a surface plate.

If the degree of the angle and the dimension of one side are given, the dimension of the other side can be found by setting the protractor to the given angle and the scale to the given dimension. By placing a second scale across the end of the first one as shown in the illustration, the dimension of the side can be found and the length of the third side determined. If the dimension of the side and either the base or the hypotenuse are given, by setting the protractor so that the given dimensions can be measured as shown in the drawing, the degree of the angle can be read on the protractor.

As an example: the drawing shows the protractor set so that the base of 4 in. and the side of $\frac{3}{4}$ in. can be obtained. With the scale B swung around so that the scale C reads $\frac{3}{4}$ in., we find the angle to be about 10½ degrees. This answer is very close to the actual answer, which is 10 deg. 37 min. If the scales have good, sharp corners and a magnifying glass is used, this degree of accuracy is sufficient.

Making a Forming Die for Ball Retainers

BY CHARLES KUGLER

IN a large ball bearing plant with which the writer was connected, the ball retainers, shown as A, were made with pockets that were drawn in by the use of the forming die indicated as B. The machining of the pockets in the forming die involved a few in-

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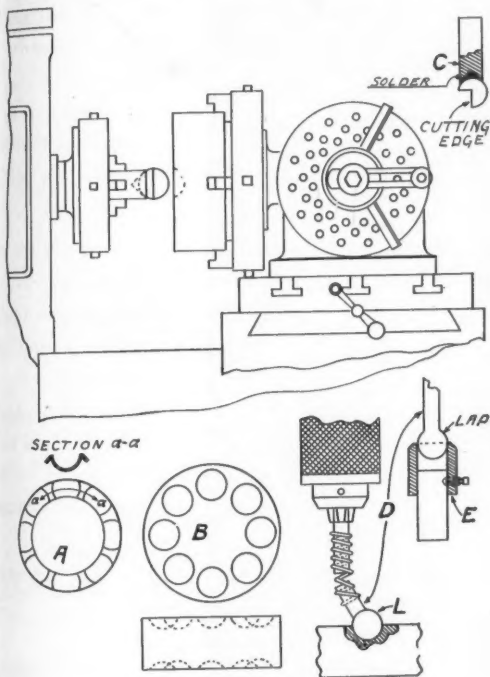
interesting "kinks" which are explained herewith.

The spherical pockets, or seats, must be evenly spaced and of the correct radius as well as the correct depth. To machine the pockets, the die is held in the chuck of an index

The lap consists of a shank with a ball on the end as shown at D, and is made in the lathe, the ball being roughed out with a forming tool to within about 0.005 in. of the correct radius and then finished by lapping with the cylindrical-shaped tool E.

With this tool it is impossible to finish the lap under-size as the diameter of the lap is determined by the diameter of the hole in the tool.

The lap is held in the spindle of a drill press, but it is not held rigidly. If it were held rigidly, it would not cut at the lower end of the axis, indicated as L in the drawing. To overcome this difficulty, the shank is severed and the upper part is held in the chuck while the lower part, carrying the lap, is connected to it by means of a coil spring. The spring provides a positive, but flexible, means of driving. By moving the work into various positions on the drill press table, all parts of the lap are brought into play and, since the neutral zone is continually being shifted, it will be found that the lap retains its accuracy indefinitely.



Drawing illustrating method of making a forming die for the production of ball retainers.

head on a milling machine table, as shown, and each seat is cut by using a tool that is made from a standard steel ball. The ball is soldered to a shank and ground to provide a cutting edge, as shown at C.

After the pockets have been cut, the die is hardened and the pockets must then be lapped to correct errors that have been caused by the hardening.

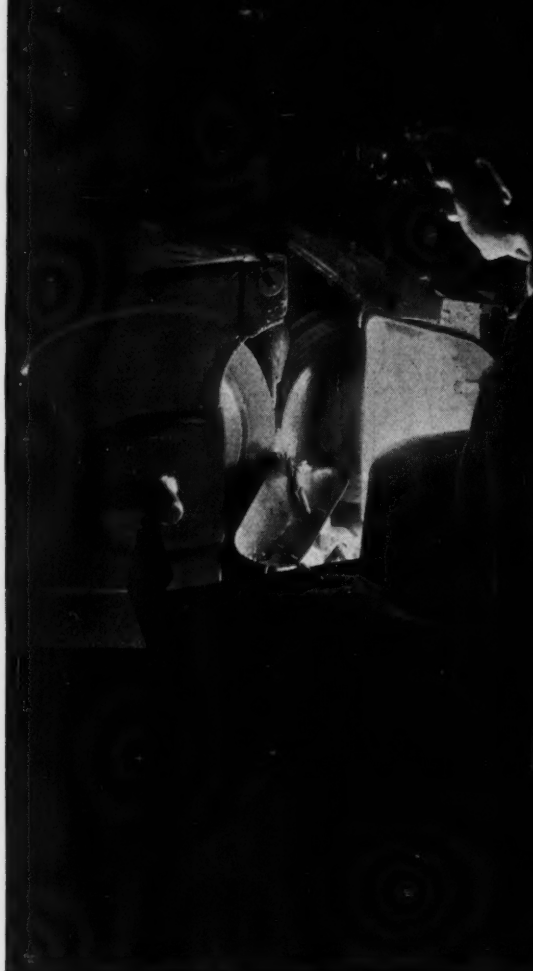
Driving Center for Cored Castings

By JOS. MASLEWSKI

THE drawing shows the design of a driving center that is being used successfully in the turning of cored castings, pipe, tubing, and similar work. The use of a center of

(Continued on page 50)

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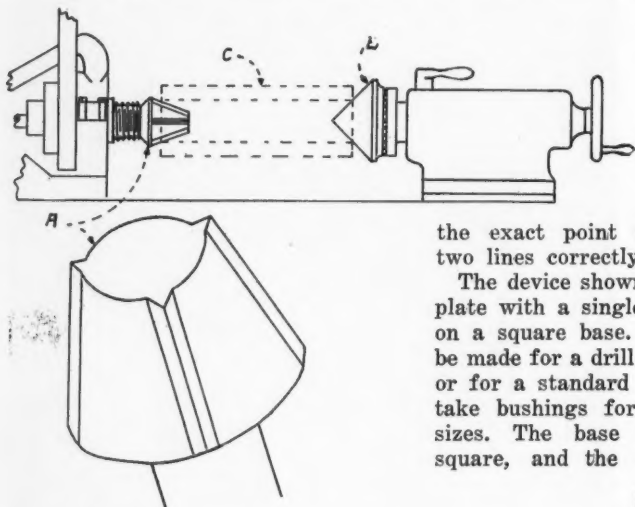


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(Continued from Page 47)

this type makes it unnecessary to hold the work in a chuck or by the



Drawing showing the use of a "knife-edge" driving center for cored castings.

use of a dog—in either of which cases it is impossible to finish the cut at one setting of the work.

As shown at A, the driving center is made with three "knife-edges" which grip the work by being forced into it as pressure is applied to the tailstock center. As it is imperative that enough pressure be applied so that a good grip is obtained, better results will be obtained if a ball-bearing tailstock center is used, as indicated at B in the illustration. The work is indicated by the dotted line C.

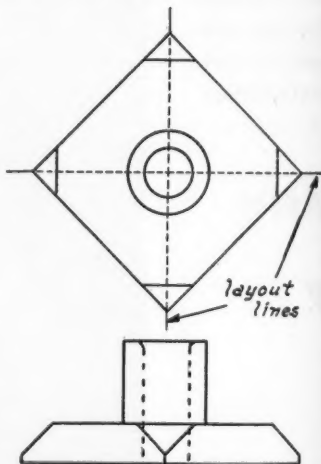
A Handy Drilling Kink

BY PETER L. BUDWITZ

THE simple device indicated at A in the accompanying drawing offers a method by which holes can be drilled and reamed accurately in

jig plates, dies, and other toolwork without any preliminary prick-punching. While it is a comparatively easy matter to scribe layout lines on a workpiece when the proper methods are used, every experienced mechanic knows how difficult it is to center - punch the exact point of intersection of two lines correctly.

The device shown is in effect a jig-plate with a single bushing mounted on a square base. The bushing can be made for a drill of convenient size, or for a standard center drill, or to take bushings for drills of various sizes. The base must be exactly square, and the corners should be



Drawing of jig for locating a drill accurately without center-punching.

beveled off to facilitate setting. To locate the bushing centrally over the intersection of the layout lines, it is only necessary to set the corners of the base exactly on the lines. It may

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then be clamped, if desired, by utilizing the base for this purpose. It is obvious that the opportunity for error will be reduced by using this tool, and there will be no chance for the drill to run off to one side as it might if no bushing were used. In addition, it will save a lot of time.

A Crib Man Speaks

(Continued from Page 26)

attitude on your part because he knows you are taking him from a job that requires his best to handle, and a poor one will lose enough tools for you to pay a good man a respectable salary.

Impress on the crib man's mind that his job is to save the company money in lost and broken tools, and to help prevent mistakes, and you will find a goodly number of dollars being added to the profit side of the ledger. At any rate, don't make the mistake of considering the crib a necessary evil; instead picture it as the heart of your plant and take my word for it, the best man money can hire is none too good.

4TH EDITION PARKER-KALON CATALOG—DATA BOOK. Parker-Kalon Corporation, 200 Varick St., New York, N. Y., has issued the fourth edition of its catalog and data book, presenting 36 pages of information and technical data relating to the use of screws and nails. The major part of the book is devoted to self-tapping drive screws, with information as to the advantages of these screws and technical data regarding the kinds and sizes to use for fastening the various types of materials.

The subjects covered by the several chapters include self-tapping screws for joining sheet metal from 28 gauge to 6 gauge; hex head hardened cap screws for fastening sheet metal to structures of heavier materials; non-corrosive self-tapping screws for joining or making

fastenings to Monel Metal, brass, copper, zinc, aluminum, die castings, and steel up to 0.062 in.; hardened self-tapping drive screws for fastening sheet metal up to 18 gauge; hardened screw nails for fastening sheet metal to wood; hardened masonry nails; cold-forged wing nuts and cold-forged thumb screws.

Tables show the relative sizes of hardened self-tapping screws compared with machine screws and cap screws, and the book includes a number of tables that are of use to every engineer or plant executive.

A copy will be sent to any design engineer or mechanical executive upon request.

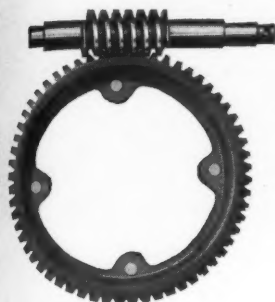
DIAMOND CHAINS AND SPROCKETS. Catalog No. 583, issued by the Diamond Chain & Mfg. Co., 459 Kentucky Ave., Indianapolis, Ind., gives complete information regarding the design, selection, and use of Diamond Roller Chain Drive. Tables are given showing the dimensions, strengths, and weights per foot of the different sizes of chain, with tabulated figures as to horse power ratings and corresponding working loads.

The engineer will find in this book all the information he needs to make possible the correct selection of a chain and sprockets for a chain drive. Copy free upon request.

LANDIS BULLETIN F-80, issued by Landis Machine Co., Inc., Waynesboro, Pa., contains complete descriptions, specifications, and illustrations of the Lanco, Landex, and Landmatic hardened and ground die heads made by this firm. The Lanco heads, Type V, are intended for use with hand and automatic threading machines; the Landex heads, Type L, are for automatic screw machines, and the Landmatic heads, Type H, are for turret lathes. Copies free upon request.

MOTOR APPLICATION CHART. The Engineering Department of The Louis Allis Co., Milwaukee, has prepared a very comprehensive application chart showing twenty-nine different types of electric motors and listing the proper motor for over fifty different standard applications.

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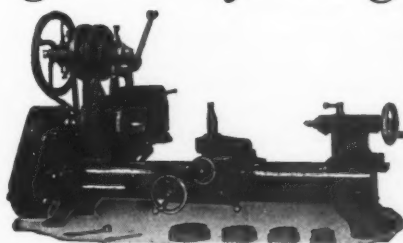
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Over the Editor's Desk

Foremen-Salesmen

OCCUPIED with duties which involve to a large extent the ironing out of troubles with tools, machines, materials, or help, the foreman or other department head rarely gives thought to the fact that he is also a salesman.

The continuation of his job depends upon the success of the firm in marketing its product. The success of the firm in marketing its product depends to a large extent upon the care with which the product is made and the manner in which delivery dates are met. For these facts the foreman is very largely responsible, and to this extent he is a very important part of the sales force.

The foremen, as well as others in the manufacturing end of the organization, look upon the salesman as being a free and roving individual who is subject only to the dictates of his own desires, who plays golf and entertains customers at dinner, and who unloads whatever troubles he encounters upon plant executives.

But there is another side to this picture—a side that the plant executive is prone to overlook. Selling involves long and irregular hours, nights spent on the train, noisy hotels, and few home comforts while traveling. The salesman is on the firing line. His is the first line of offense and defense. Not only must he find and make opportunities for sales in order to keep the factory running, but he must act as a shock absorber for all the complaints and dissatisfaction regarding his product. Unless he has sufficient and capable support at the plant, he—and the company behind him—must fail. And

that is where the department head fits into the sales picture.

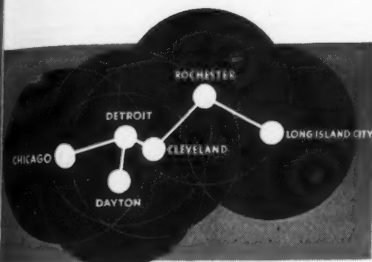
The success of each individual of the organization depends upon the ability to market the product. Most lines of business depend upon repeat orders, and repeat orders depend upon satisfied customers. Satisfaction is evident only when a purchased article bears out the claims made for it by the manufacturer.

When a salesman finds that these claims are not justified, he is not only greatly embarrassed and disheartened, but he stands to lose all the hard work, time, and expense that he has put in in the hope of making a sale. He has perhaps overcome the sales resistance of the prospect, only to find that the greatest sales resistance is a deficiency in his own merchandise.

Every sale made is a step forward for each individual member of the organization, and every sale lost is a step backward—toward failure. When a salesman loses a sale because his merchandise is defective, he has not only lost his own time and money, but the firm has lost a large part of the money spent in building and transporting the article. Thus to a certain extent the future of the firm is jeopardized and with it the future of every individual in the organization.

Each plant executive should take the same interest in turning out quality merchandise that he would unquestionably take if he expected to have to sell that same merchandise himself. If he will adopt this attitude, the salesmen's respect for the plant will be increased and the public's respect for the product will be increased. All of which promotes success for every one concerned.

June, 1934



LESS Than a Night's Ride Away

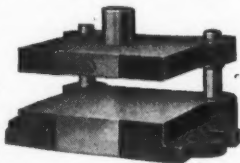
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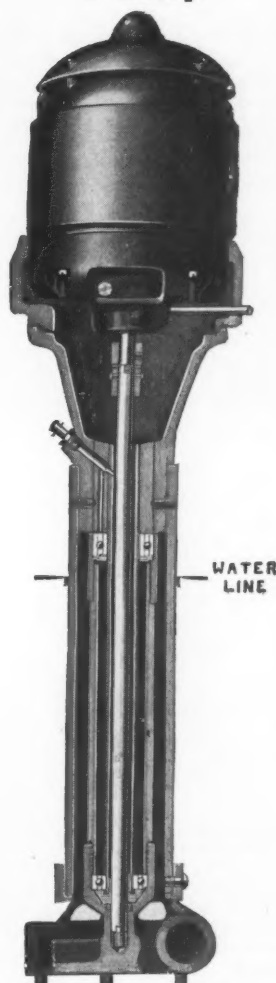


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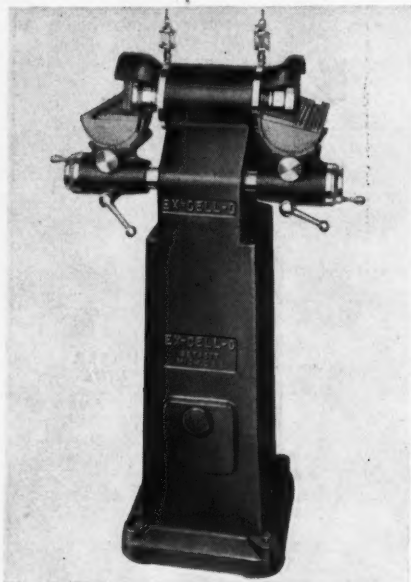
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Ex-Cell-O Grinding and Lapping Machine

A grinding and lapping machine, especially designed for use in sharpening cemented carbide tipped tools, has been placed on the market by Ex-Cell-O Aircraft & Tool Corporation, 1220 Oakman Boulevard, Detroit, Michigan. Through



Ex-Cell-O Grinding and Lapping Machine for Cemented Carbide Tipped Tools

the introduction of hardened and ground plates on the surface of the tables at each end of the machine, as illustrated, it is said that greater accuracy can be maintained. These strips reduce wear on the surface of the table and make it easier to keep the top of each table clean while the machine is in operation.

These strips are mounted on adjustable "U" shaped tables which have a horizontal micrometer adjustment. Two hardened and ground strips are mounted parallel with the face of each wheel, on

top of the table, and two eccentric plates are provided between the strips to aid in aligning them properly. These strips form a slot which acts as a guide for the tool support. Across the end of each table and in front of each wheel is mounted another hardened and ground plate. "U" slots are machined lengthwise in each strip.

An inbuilt balanced motor with double end shaft projection is mounted at the top of the main casting. The motor is rated at $\frac{3}{4}$ h. p., 3450 r. p. m., and can be furnished for either 220, 440 or 550 volt, three-phase, 60 cycle current. Ex-Cell-O Precision Ball Bearings are used on each end of the motor, thereby eliminating end play. Suitable dust caps are provided to protect the bearings from dirt and foreign material.

A ring-type grinding wheel is used at one end of the motor, and is mounted on a steel plate with countersunk holes for the mounting screws. This wheel is cupped and permits the use of the entire thickness of the grinding wheel. The wheel is 6 in. in diameter with a $1\frac{1}{4}$ in. grinding surface on the side of the wheel. Softer wheels are used on this machine due to its unusual rigidity.

The special iron lapping disc is 6 in. in diameter with a $\frac{3}{4}$ in. lapping surface on the back. When a large number of right and left-hand tools are to be ground on the same machine, a motor reversing switch should be installed.

Taylor "Hi-Eff" Static Balancing Machines

The "Hi-Eff" static balancing machine shown in the illustrations are being offered by the Taylor Manufacturing Corporation, 2330 West Clybourn St., Milwaukee, Wis., for the balancing of flywheels, pulleys, pump impellers, gears, and similar parts.

The machines are universal in their adaptability for various shapes or sizes of parts without the necessity of change in set-up. This feature makes it possible to change from balancing one type of part, such as a flywheel to the balancing of other parts, such as pulleys or gears, of different sizes or weights without any change in set-up other than giving the threaded portion of the cen-

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centering spindle a turn or two with the fingers. Revolving this piece adjusts the weighing fulcrum to the center of gravity of the part to be balanced.

Unbalance can be corrected as close as 0.01 inch-ounce on the smaller models and up to 0.1 inch-ounce on the largest.



Fig. 1—"Hi-Eff" Static Balancing Machine

The balancers are built in standard models to handle parts as light as one ounce and as small as one inch diameter, up to the larger sizes which will balance parts up to 48 inches diameter and weighing up to 600 pounds.

Speed in production, which is the feature of the "Hi-Eff" machine is obtained through a number of features. The locating of the heavy spot is almost instantaneous through the use of a very sensitive spirit level. The weighing of the unbalance is accomplished either by a hand-operated weighing beam or through an automatic weighing dial, the latter taking but a few seconds to automatically record the exact amount of inch-ounce unbalance in the part. After the amount of unbalance has been determined, the usual delay in calculating the number of holes to be drilled and their depth is automatically eliminated by the use of the automatic calculator shown at the left of the machine shown in Fig. 1. By setting the indicator on a line for the inch-ounces unbalance, the number of holes required and their depths is indicated by the calculator for the particular point at which the drilling is to be done.

In operating the balancer, the work-piece is placed in position on the base of the machine with the centering spindle through the bore of the piece. Bushings are provided for various sizes of bore. A turn of the right ball crank lifts the piece into balancing position, the heavy spot tilts the piece, and the bubble in the spirit level moves to the opposite side. The heavy side is then swung, on the cradle, to a point opposite the weighing beam and the unbalance is weighed in inch-ounces or decimals thereof. By turning the left ball crank, the piece is moved so that the drill will come directly over the spot where the excess material is to be removed.

The calculator has moved with the base through this procedure, and the operator reads, direct, the number of holes to be drilled, the radius upon which they are to be drilled, and their depths in thousands of an inch. The right hand lever is turned back to first position, which lowers the piece onto the frame and locks the weighing mechanism. The drilling is then done. The right hand lever is turned again to the right, which again

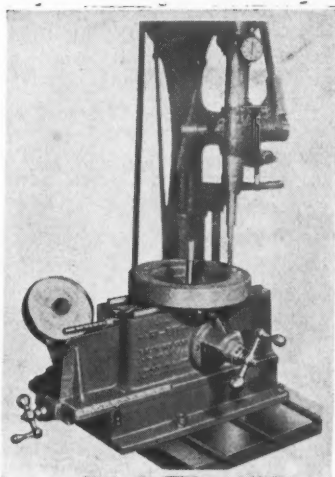


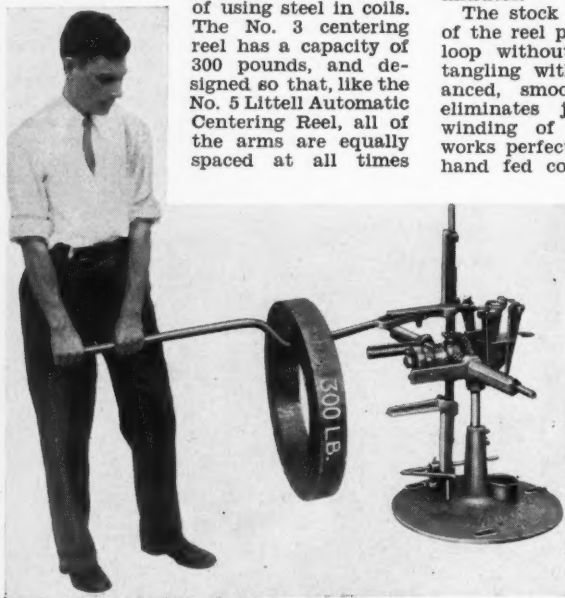
Fig. 2—"Hi-Eff" Balancing Machine Built Integral with Drill Press.

raises the work into balancing position and the weighing beam weight is set at zero, which checks the accuracy of the calculations and drilling.

In addition to the models which can be used on any available drill press, production line models are built with integral bases and drill heads. Models for balancing light weight parts are of the lever type and can be had for use on any available drill press or in production line models.

Littell No. 3 Automatic Centering Reel

The F. J. Littell Machine Co., 4127 Ravenswood Ave., Chicago, Ill., has added to its line of centering reels a No. 3 reel, the features of which are intended to simplify the matter of using steel in coils. The No. 3 centering reel has a capacity of 300 pounds, and designed so that, like the No. 5 Littell Automatic Centering Reel, all of the arms are equally spaced at all times



Littell No. 3 Automatic Centering Reel.

from the center of the reel. In other words, when a coil of larger diameter is to be placed in position on the reel, the arms can quickly be extended by revolving the reel like a capstan.

The coil is balanced on the reel regardless of the size of the coil, which promotes smooth, easy operation when the press is running.

An additional feature of the No. 3 reel is the quick loading lever, by the use of

which one man can load a coil on the reel. The quick loading lever is anchored to the upper arm by means of a snap pin, as shown. When ready to put on a new coil, the operator removes the keepers, then he locks the gear to prevent rotation during the loading operation. By revolving the reel to the right, he automatically brings all four arms in toward the center. A new coil is slipped onto the loading bar, as illustrated, and placed in position on the arms. The keepers are replaced and the reel is revolved to the left, thus expanding the arms to grip the coil from the inside. The gear latch is released and the reel is ready to operate. The entire time consumed in loading averages 1 1/3 minutes.

The stock support arm at the bottom of the reel permits running with a loose loop without danger of the stock entangling with the reel arms. The balanced, smooth operation of the reel eliminates jerking and irregular unwinding of the stock; thus the reel works perfectly with a roll feed or with hand fed coil stock. It may be tilted to any angle and adjusted to any height. The reel can be furnished with motor drive if requested.

Harvey "Butterfly" Filing and Die Making Machine

The illustration shows a filing and die making machine that has been placed on the market by the Harvey Manufacturing Corp., 210 Center St., New York, N. Y. The machine is especially intended for sawing, filing, and lapping on dies, gages, and other tools up to 1 inch in thickness.

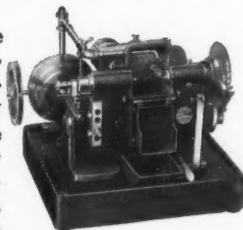
In setting up for operation, the saw is tightened at one end in the chuck;

the other end is clamped to the slide of the overarm. A spring in the overarm provides proper tension for sawing out the die at the desired angle within a few thousandths of an inch of the marked line, leaving very little metal to be filed out. The work is tightened in position by means of a clamp which holds it at any desired angle, the directed force being in line with the saw.

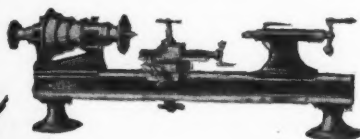
An overarm is provided for either filing

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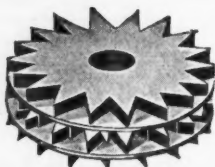
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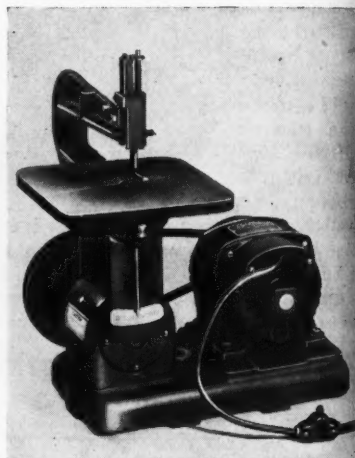
We manufacture the only complete line of wheel truing tools.

Write for copy of Catalog "M" and name of your nearest dealer.

The Desmond Stephan Mfg. Co.,
URBANA, OHIO

or sawing. When filing, a file roller support is used and the work is held by means of a finger which is clamped to the desired position. The file can also be used without the support. The chuck is universal, with two hardened jaws.

The surface table is 10 in. square, and



Harvey "Butterfly" Die Making and Filing Machine

can be tilted to an angle of 10 degrees in either of two directions. Provision is made on all tables for attaching a screw feed sawing attachment.

The machine is powered by a ¼ h. p. electric motor, either a. c. or d. c., and the drive is through a v-belt to a two-speed pulley. The machine has a stroke of 1¾ in. and can be operated at speeds of from 450 to 600 strokes per minute. Standard equipment includes two hold-down brackets, one insert stem, one file roller support, two fingers—one flat, one round, v-belt, and a pan for catching waste oil and filings. The machine weighs 112 pounds with motor and standard equipment, and occupies a space 18½ by 18½ inches.

Jones & Lamson Stationary Type Tangent Dies

The Jones & Lamson Machine Company, Springfield, Vt., has brought out a line of Stationary Type J & L Tangent Dies. These dies are of the pull-off type and have several unique features in addition

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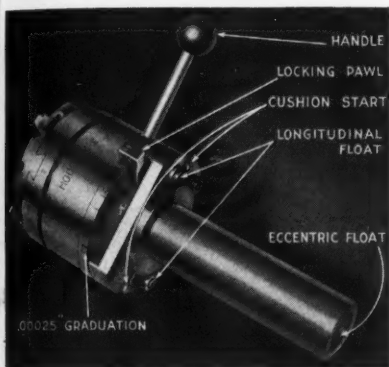
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to those embodied in the J. & L. Revolving Type Tangent Dies, which have been on the market since 1929.

The chaser holders are ground and lapped on the dovetails and take a wide bearing surface on the ground and lapped dovetail slots in the die body, as well as on the die body face. These holders can be changed, if necessary, without disassembling the die. The dies are locked by pushing the locking lever



Jones and Lamson Stationary Type Tangent Die

handle in one direction and may be tripped, when desired, by pushing it in the opposite direction.

To make pitch diameter adjustments, a spring-operated pawl, which engages teeth on the adjustment nut, is raised and the adjusting nut moved to the proper position. After adjustment, the pawl is permitted to settle back in the proper tooth where it securely locks the adjusting nut. The teeth on the adjusting nut permit adjustments of 0.00025 in. In addition to this, the diameter of the die plate, adjacent to the adjusting nut, is provided with wide-spaced graduations to permit adjustments of 0.001 inch.

The dies are equipped with two springs set up under a pre-determined pressure to permit a cushion start, thus eliminating the solid impact of the chasers and work. They are also provided with longitudinal float which permits the chasers greater freedom to reproduce their own accuracy. The driving flange is screwed onto the shank and dowelled in place, thus affording a drive at a point farthest

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1350 Columbia Road, Boston, Mass.
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from the center of the die. This driving arrangement also permits eccentric float to take care of misalignment of the die and work.

The amount of eccentric float is determined by the clearance allowed between the outside diameter of a shank integral with the die body and the bore of the outer shank sleeve. On most machines requiring stationary dies, such as hand screw machines, turret lathes and Cleveland automatics, a long shank may be employed. By controlling the float in this long shank, the face of the die remains more closely at right angles to the center of the work than is possible when the provision for float is confined to a shorter hook-up.

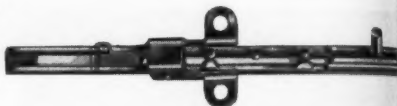
The chasers for these dies are all ground in the thread form at the exact helix angle for the diameter and pitch of the thread to be cut. All chasers are interchangeable in revolving and stationary dies of the same capacity. Only one set of chaser holders is required for any right hand threads within the rated die capacity, whether standard or special and regardless of diameter or pitch, thus eliminating the expense and trouble of numerous chaser holders.

The new Stationary Type J. & L.

Tangent Dies are available in five sizes with a threading range from No. 8-32 to 1 inches diameter.

Krasberg Automatic Stop

An automatic stop for blanking dies which, it is said, can be fitted to any blanking die in 25 minutes, has been placed on the market by R. Krasberg



Krasberg Automatic Stop

Sons Mfg. Co., 2310 Wolfram St., Chicago, Ill. The stop is strong, simple in design and construction, and is furnished complete so that it can be applied by merely drilling an 11/32-in. hole and drilling and tapping two No. 10-32 threads in the stripper.

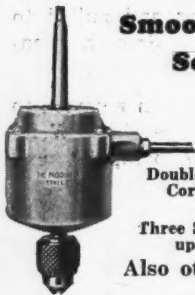
The tripspring and pivotspring are made integral with the stop. On the down-

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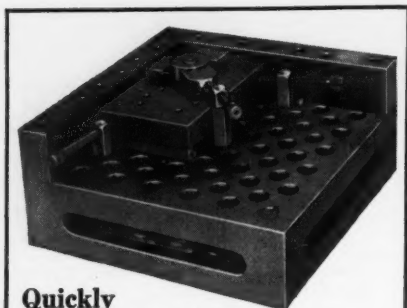
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stroke of the press the tripspring lifts the stopfinger away from the die and the pivotspring tips the stopfinger slightly to the right. On the up-stroke of the press the stopfinger comes to rest on the top of the material, and while the material

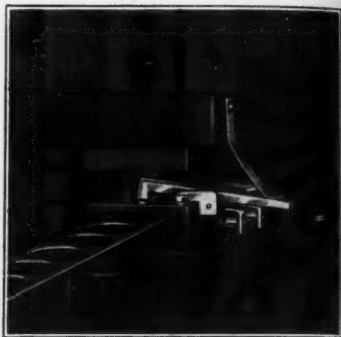


Illustration showing application of Krasberg Automatic Stop.

is being fed to the left, the stopfinger snaps into the opening made by the punch. Thus the material is positively stopped and gauged for the next down-stroke of the press. Except for fitting the gauging end, the stop comes ready to use. It is made in two sizes; 2% in. and 3% in.

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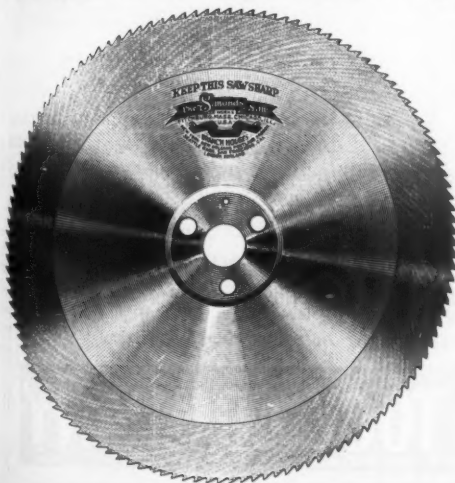


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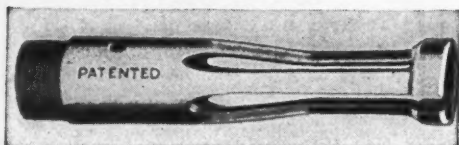
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machine parts by the addition of the "Modern Master" Pusher and "Modern Master" Finger Holder.



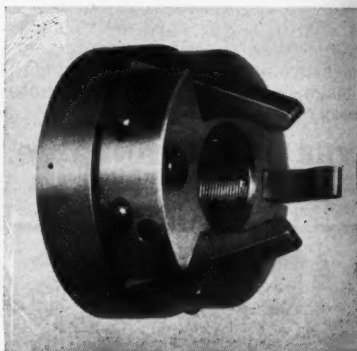
Feed Finger for "Modern Master" Stock Pusher

The pusher is so designed that no screws are used in its construction, yet the pads cannot come loose. The pads are made from tool steel, hardened and polished, or they can be furnished in bronze, cast iron, or chrome plated steel. The pads are interchangeable and are made in many sizes not usually available. They are easily changed, and no special tools are required.

The pusher is made from a steel of special analysis, and designed so as to provide a long, flat surface grip. Only one is needed for round and hexagon stock and one for round and square stock. The pusher is highly tempered,

assuring long life, and when it becomes loose through long wear it can be tightened to any desired tension. Oversize material can be used when this pusher is used, which is an advantage in many cases.

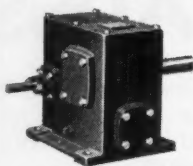
The "Modern Master" Finger Holder is made of a grade of steel that has been selected as being especially suited for the purpose. All holders are heat treated for durability and machined to a fine degree of accuracy so that all holders are interchangeable. Equalizing members are incorporated in each holder, and the load is automatically distributed to three fingers, instead of the usual two, thus providing increased gripping power.



"Modern Master" Finger Holder

All of the locking power is applied directly to the collet, providing a tight grip with a minimum of power consumption.

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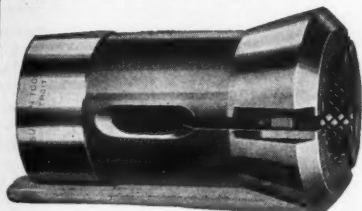
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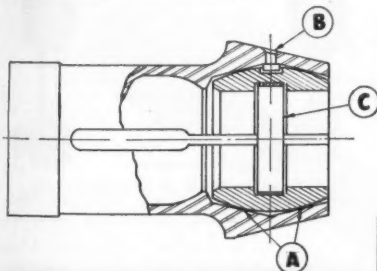
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Grips effectively under one-third to one-half less tension than necessary for ordinary master-type collet. Adjusts itself to surface inequalities of hot-rolled stock. Cross-section below shows some reasons why—



A—Angular seat in master and radius on back of pad allow pads to adjust to perfect bearing on stock. B—Pins prevent pads rotating. C—Flat spring holds pads in master. New Catalog No. 12 gives full details. Send for a copy.

Sutton Tool Company

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TIME STUDY NEWS

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TO THE TIME STUDY MAN: Regardless of your ability, we are confident we can help you broaden your training to meet new issues imposed by these industrial recovery days. Time Study work is a vast subject and you cannot know too much about it. Our course of training will unquestionably help you.

TO OTHERS: Engineers must supplement their training with an exact knowledge of time study work. Foremen find our training of inestimable value in making proper analysis of their work. Many others are finding our course the means by which new, high salaried positions are opened to them.

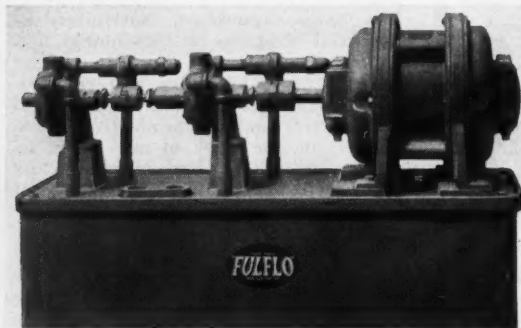
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Box 366B, Norwalk, Connecticut.

"Fulflo" Motor Driven Geared Oil Pump and Tank

The illustration shows the "Fulflo" Motor-driven Geared Oil Pump and Tank, which has been placed on the



"Fulflo" Motor-Driven Geared Oil Pump and Tank

market by Fulflo Specialties Company, Blanchester, Ohio. The unit consists of a motor, tank, and two "Fulflo" spiral-geared pumps, comprising a complete

hydraulic unit. While efficient in the operation of any type of mechanical unit up to its maximum power capacity, the unit is especially adapted for use in the operation of machine tools.

The feature of the unit is the dual control, which makes possible two separately-controlled hydraulic movements such as would be required in the operation of two different truing devices on two different grinding wheels on a single machine. Although powered by a single motor, separate relief valves provide for by-passing so that the oil pressure required can be maintained in each pump.

The unit is mounted on a cast iron base which in turn is mounted on a steel supply tank. The motor is $1\frac{1}{2}$ h.p. a. c. or d. c., operating at 1140 r.p.m. The maximum pressure on each pump is 200 pounds, and each pump will deliver a maximum of approximately 3 gallons per minute at the speed indicated. The pumps are connected to the motor by flexible coupling, as shown.

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DESIGNED for heading rivets cold from $\frac{1}{16}$ " to $\frac{1}{2}$ " at high production. The bottom of threaded hole in riveting tool (or peen) is made flat so as to butt against the lower end of hammer spindle to insure a solid blow. Note the rugged construction throughout . . . the 3 step cone pulleys provide great adaptability. Illustrated folder tells of the many other improvements. Write for your copy today.

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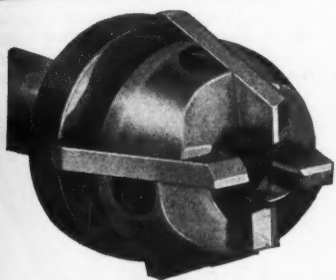


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Cimatool-Paulins Tool Jig

Having acquired the Paulins Tool & Engineering Company of Detroit, the City Machine & Tool Company, Dayton, Ohio, has redesigned the patented "Paulins" jig to increase the effectiveness of the jig design and to improve its flexibility.

The Paulins linkage and locking designs, long recognized for their dependability, greater clamping power and operating speed, have been preserved in the newer designs. In the spring type mechanism, the two springs exert from 90 to

105 lbs. pressure. The accumulated experience of Cimatool specialists has been utilized to simplify and improve bushing plates and other details for both single and double post models. This re-design

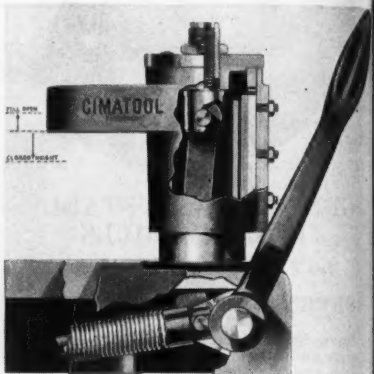


Illustration showing design of "Cimatool-Paulins" jig.

work also includes both positive lock and spring type mechanisms.

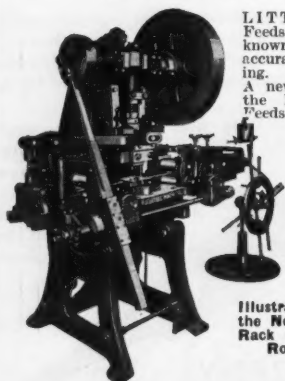
As shown in the accompanying illustration, all parts of the toggle and clamping mechanism are fully enclosed and protected, preventing interference from chips. A large-diameter barrel materially adds to the sturdiness of the tool.

In these new tools production finds the answer to the insistent demand for greater economy without jeopardizing accuracy. Changes in design of manufactured parts need not obsolete a jig of this kind. The main body of the tool remains serviceable in the face of even drastic production changes. If a new bushing plate becomes necessary, it can be furnished from stock.

A complete stock of jigs and parts

HAMMOND
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Electrically Driven - Belt Driven
In a Complete Range of Sizes and Types
Hammond Machine Builders
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LITTELL High Speed ROLL FEEDS



LITTELL Roll Feeds are well known for their accuracy of feeding.

A new feature of the Littell Roll Feeds is a disc which shows exactly what feed length it is set for. The Feed can be quickly set for a new job.

Illustration shows the No. 3 Double Rack and Pinion Roll Feed.

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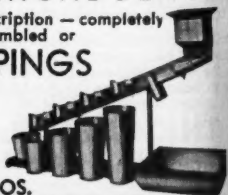
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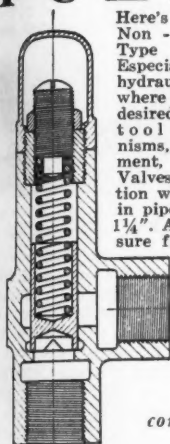
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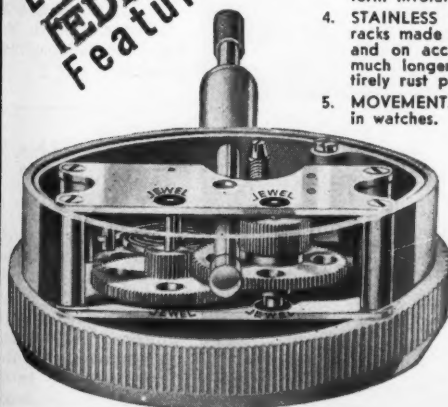


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now maintained in Detroit as well as at plant headquarters in Dayton. For users who desire to utilize the Cimatool-Paulins special lock on jigs of their own design, these locks are available.

Russell Boring Bar

The illustration shows a heavy duty boring bar with micrometer adjustment and of extraordinary range that has been developed by Roy V. Russell, 1207 Calumet Ave., Middletown, Ohio, for use with milling machines, boring machines, lathes, drill presses, and so on. The tool consists primarily of a tool block that is gibbed to a slide which, in turn, is made integral with a shank. A T-slot in the block gives a certain

amount of range for the setting of the tool, as shown, this range being augmented by a leadscrew with micrometer head.

The entire tool is made of special high



Russell Boring Bar

grade steels, machined all over and constructed to the finest degree of accuracy. It is, however, of rigid construction, and is intended to meet, in every way, the

needs of the tool and die maker. The tool as shown will bore from 9/16 inches to 12 inches diameter by adjusting the slide, and is furnished with three boring bars as follows: 1/2 in. diameter, to bore through a 4-in. length; 3/4 in. diameter to bore through a 5 1/2 in. length, and 1 1/4 in. diameter, to bore through a 7-in. length.

The tool can be made up with No. 8, 10, 11, or 12 B & S taper shank, or No. 4, 5, or 6 Morse taper shank.

DRILLING

Rotor governor controlled tools drill more holes with fewer twist drills. The governor prevents racing and burning of drill points, but maintains the correct full speed.

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The Rotor Air Tool Co.
Cleveland, Ohio



South Bend No. 5 "Workshop" Lathe

A new back-geared screw cutting lathe of 9 in. swing, available with counter-shaft drive or with motor drive, has been announced by the South Bend Lathe Works, South Bend, Ind., under the name

Mark It - - QUICKLY

No Stray Numbers to Get Lost



Numbers in
Perfect Alignment
1 to 8 Wheels
Shank for Hand
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Latest hardening
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methods insure
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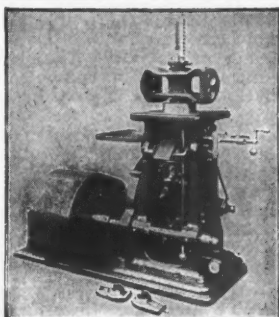
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80 years
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Straight or taper keyways from 3/32" to 5" wide and up to 60" long in either straight or taper bores can be quickly cut on the GIANT Keyseater. Set up is fast and accurate . . . no bolts or clamps necessary. Work is held and aligned by its bore. Feed is automatic with accurate depth gauge. Cut automatically stops at depth set.

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A Complete Line of Standard Cutters Carried in Stock At All Times.

of the No. 5 "Workshop" Lathe.

This lathe is particularly intended for shops needing inexpensive equipment to handle small work. Design of the lathe is ultra simple and controls are simplified so that the lathe may be operated not only by the experienced machinist and lathe hand, but by the novice as well. All fundamental machining operations may be performed with this lathe, including the cutting of screw threads, right or left hand, from 4 to 40 per inch.

Mechanical features of the "Workshop" lathe include a six speed back-geared headstock; hollow headstock spindle for

handling bar and chuck work; automatic power feed to carriage; ballcrank hand cross feed; graduated compound rest swiveling to any angle; graduated tailstock with set-over for taper turning heavy nickle-steel-iron lathe bed having three V-ways and one flat way to in-



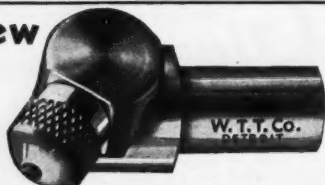
South Bend No. 5 "Workshop" Lathe

sure perfect alignment and performance of the headstock, tailstock and carriage. "Workshop Booklet" No. 5-W describing this lathe may be obtained by any reader by writing to the Technical Service Dept., South Bend Lathe Works, South Bend, Ind., and mentioning the name of this publication.

Skilsaw Electric Drill

Skilsaw, Incorporated, 3316 Elston Ave. Chicago, Ill., has augmented its line of electric hand saws, electric portable hand sanders, electric blowers and other electric tools by the addition of a complete

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The NEW TRUCO Dresser is the last word in efficiency, flexibility, and economy. Write for details and prices.

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**Reduces
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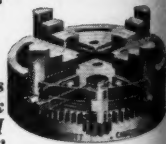
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DIE MAKING MACHINE

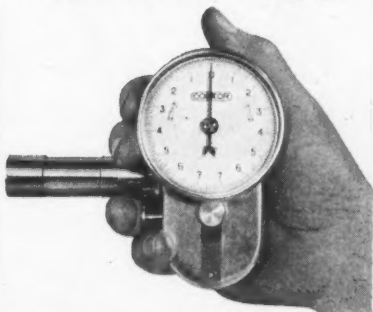
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Light in Weight and Plenty of Power

THE NEW DUMORE MODEL 8 H-G

Craftsmen in tool rooms, pattern, machine and engraving shops, will welcome this new grinder that handles like a pencil.... It is almost indispensable where hand grinding is required.... This new grinder weighs only 1 lb. 10 ozs., is equipped with a 1/40 H. P. universal motor which has a speed of 15,000 R.P.M.; 1/8" capacity chuck, toggle switch, 8 feet of rubber covered cord, and a set of 3 grinding wheels on shanks.... The price is only \$17.50 and is available thru your industrial distributor.

Send for descriptive literature.
DUMORE COMPANY
28 Sixteenth St., Racine, Wis.

DUMORE
GRINDERS

CAN BE USED LIKE A PENCIL

The light weight and balance of this new grinder makes it easy to use. With it, small precision jobs such as illustrated can be handled quickly and efficiently.





Skilsaw Electric Drill

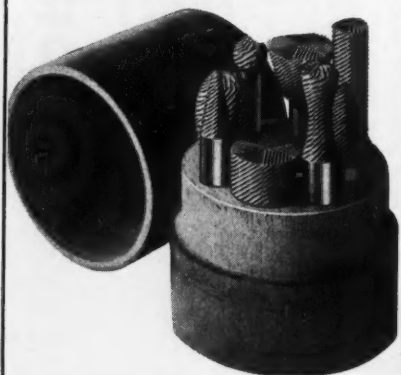
line of electric portable drills. The line includes eight types of drills in four sizes— $\frac{1}{4}$ in., $\frac{5}{16}$ in., $\frac{3}{8}$ in., and $\frac{1}{2}$ inch. The motors used in Skilsaw electric drills are of the universal type and will

operate efficiently on either alternating or direct current. Armatures are balanced both statically and dynamically to insure perfect balance and the elimination of vibration. Brushes are of the oversize cartridge type, self-adjusting, with uniform spring tension. They are easily accessible. The motor is cooled by a balanced fan mounted on the armature shaft. The motor is controlled through an enclosed make-and-break switch of patented snuff arc construction. Radial and thrust grease seal ball bearings are used on the running parts.

The bodies of Skilsaw drills are of die cast aluminum alloy, reducing weight to the minimum. Balance has been considered in the design, to promote ease in handling and to reduce fatigue. Exposed steel parts are rust-proofed to avoid rusting. Chucks are made by a well-known chuck manufacturer.

Standard equipment includes a three-conductor rubber-insulated copper lead-in cord of convenient length, securely clamped to the handle and protected by a spring wire guard. A ground connec-

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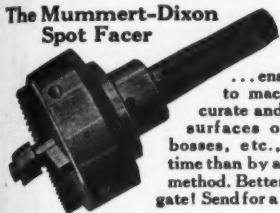
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is a combination Mannheim, Polymetric Log-Log, Binary, Add and Subtract Slide Rule. It will instantly add, subtract, multiply and divide any combination of whole numbers, fractions, mixed numbers and decimals. Gives every root and power, also Logs, Sines and Tangents. Made of aluminum with scales on white celluloid enamel. Size 4 in. Approved and adopted by colleges. Price with instructions and Fabrikoid Case \$2.00. With leather case \$2.50. Sent C.O.D. if desired. Catalogue Free



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A simple and excellent device for balancing, straightening and truing.

They are made in the following sizes:

Swing	Greatest Distance Between Standards	Capacity in Lbs.
20 in.	20 in.	1,000
40 in.	30 in.	2,000
60 in.	30 in.	2,000
72 in.	66 in.	5,000
96 in.	88 in.	10,000



Four chilled iron discs rotate on sensitive special bearings

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Mfd. By **Anderson Bros. Mfg. Co.**
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The Cullman Lathe Drive

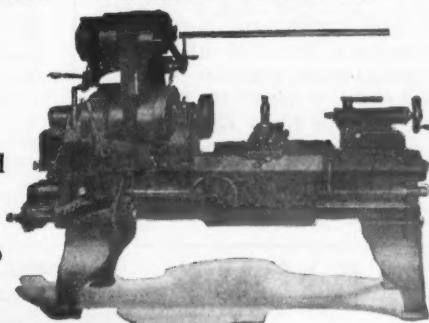
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with

Belt Drive Smoothness
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**LATHES, SHAPERS and
MILLING MACHINES**

Easily Installed.

4 bolts attach this unit to
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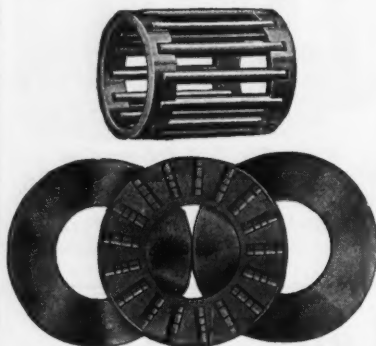
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tion, integral with the cord, provides a safety feature.

Forsberg Fluted-Handle Screwdriver

The Forsberg Mfg. Co., Bridgeport, Conn., has brought out a screwdriver with a self-locking ferrule, so designed that it is practically impossible for the blade to loosen in the handle. The ferrule is of hexagon shape and is a rigid casting. It has the usual taper but also has a series of fins which, when forced on the tenon of the handle, imbed firmly in the wood, thus providing additional locking surface and preventing turning.

The fins have a series of notches which provide a "fish-hook" effect so that, when pressed on, the wood is imbedded under the recess and the ferrule cannot be driven off. The hexagon shape of the ferrule also prevents the screwdriver from rolling, and the radius, or curve, is so shaped as to fit the thumb.

The handle has machine-cut flutes that are deep enough to provide a positive grip and prevents slipping in oily hands. The drive plug is made of steel and the knurled blade is driven into a correctly-sized hole to insure a tight drive. It is said that the blade will never work loose. The ferrule end has a steel bushing, welded to the driver. The blade is hardened and tempered for its entire length.



**Forsberg
Fluted-
Handle
Screw-
driver.**

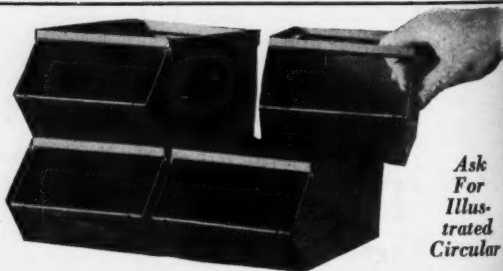
SAVE SPACE TIME AND LABOR

Cut handling costs—eliminate waste motions—save time with Stackbins.

The contents of each individual Stackbin are always accessible without disturbing the bins above or below.

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MODERN "SELF-OPENING" STUD SETTERS ARE USED

IN 90% OF THE AUTOMOBILE SHOPS

Because They Are Speedy, Accurate
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This tool will set studs to an absolute given height, and is so constructed that the threaded jaws remain in full contact with the thread on the stud until the opening action takes place. The drive is through a clutch which is adjustable for length. The jaws are fulcrumed at the top through the driving clutch, which keeps them in absolute line with each other, preventing the marking of stud being set.

OTHER MODERN PRODUCTS

Other "Modern" Products include stationary and revolving self-opening die heads, solid adjustable die heads, adjustable hollow milling tools, collapsible taps, friction tap collets, self-opening stud setters, tapping attachments, chaser grinders, inserted blade milling cutters.



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DIVISION OF CONSOLIDATED MACHINE TOOL CORPORATION OF AMERICA

ROSS *Operating* VALVES

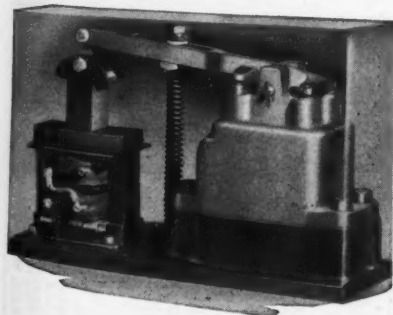
"The Bridle for Air Horsepower"

Cut Your Air Costs

With solenoid control, the valve is mounted adjacent to cylinder. Thus immediate delivery of live air against the piston insures quicker operation and less air waste.

There is a *leak proof* Ross Operating Valve for the control of every air actuated operation in your plant, whether it be hand, foot, mechanical or solenoid controlled.

Write for Catalog illustrating
Ross Operating Valves



Every manufacturer using air in any way should have the facts on the New Ross Solenoid controlled valves.

ROSS OPERATING VALVE CO.

6488 EPWORTH BLVD.
DETROIT MICHIGAN

Osgood "Super-Strong" Heavy-Duty Safety Indestructible File Handle

A split-proof file handle which is so constructed that no metallic surfaces are presented to the hand is now being made by J. L. Osgood Machinery & Tool Co. Inc., 43 Pearl St., Buffalo, N. Y. The handle is made of selected wood, especially treated for the purpose by a process which makes it exceedingly tough and resistant to wear. It is symmetrically

shaped to provide a balanced hand grip, and is polished smooth so that it will feel comfortable to the hand.

The tang of the file is held in place by



Osgood "Super Strong" Heavy Duty Indestructible File Handle

A Precision Micrometer for \$1.50

Guaranteed to be absolutely accurate. Money refunded if you are not satisfied. Size 0 to 1". Other sizes priced in proportion. Send Money Order or Check. Include ten cents to cover postage.

BRADLEY MACHINERY CO.
6502 Epworth Blvd. Detroit, Mich.



means of a long steel double flanged ferrule which is forced into the interior of the handle. The ferrule has a tapered, stepped-down hole which grips the tapered tang and holds it rigidly.

The handle is made in six sizes, from 4 in. long by 1 1/2 in. diameter for files from 2 to 4 in. long, up to handles 5 1/2 in. diameter for files up to 20 inches long.

Tasco "Indestructible" Slide Rule

A vest pocket slide rule that is small in size, light in weight, accurate, and practically indestructible has been placed on the market by Tavella Sales Company, 21 West Broadway, New York, N. Y. The scales are on a disc that is 2 3/4 in. in diameter, giving a multiplication-division scale 6.3 in. long as compared with 5 in. on the "A" scale of the regular 10-in. slide rule.

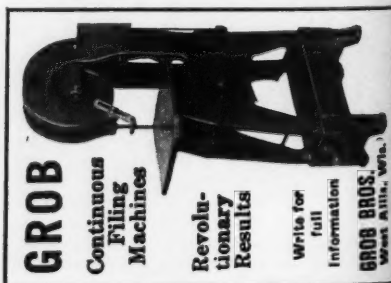
The scale graduations are etched in black on a nickel silver disc, accurately ruled and guaranteed to last indefinitely. The front side of the rule has five scales; Log, C, D, CI or C inverted, and K scale. The reverse has sine and tangent scales and an A and D scale for finding squares and square roots. An improved etching



Standardized Die Sets, embodying many exclusive features, and a listing of more than 95,000 stock sizes, afford a service that is unsurpassed.

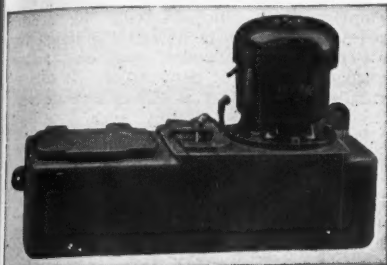
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1806 S. Kilbourn Ave., Chicago, Ill.



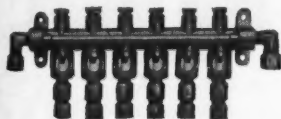
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AUTOMATIC OIL LUBRICATION SYSTEM FOR INDUSTRIAL MACHINERY



STYLE 4 PUMPING UNIT

Pulsolator's latest development, Style 4 Pumping Unit consisting of a four gallon reservoir housing double plunger lubricator pump running in bath of oil, a flange mounted ball bearing motor geared to pump shaft and a large filler port with non-detachable cover and screen. A powerful, man-sized automatic lubricator. The standard flushing lever is conveniently located to indicate the proper functioning of the system, and instantly flush all feeders whenever desired.



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Pulsolator Feeders, piped in oil circulation line, are actuated by pump pressure pulsations and can be individually adjusted by sight directly at each bearing.

One Pumping Unit can supply up to 100 bearings with individual adjustment from three drops of oil an hour to forty drops a minute. Copper drip tubes connect feeders to bearings.

All bearings can be flooded with oil at any desired moment by depressing the flushing lever.

Write for Bulletin B-5

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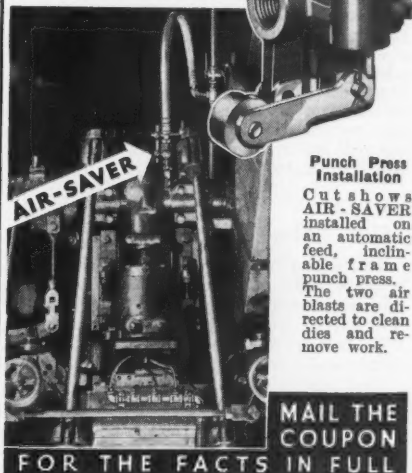
Replace with **AIR SAVERS** and your leakage troubles are over. These precision-built air valves are positively and permanently leak-proof. Valve, seat, and spring are stainless steel—wear and corrosion-proof.

Easily installed on punch presses and other machine tools. Soon pay for themselves.

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The
**LEAK-PROOF
AIR VALVE**



Punch Press Installation

Cut shows **AIR-SAVER** installed on an automatic feed, inclinable frame punch press. The two air blasts are directed to clean dies and remove work.

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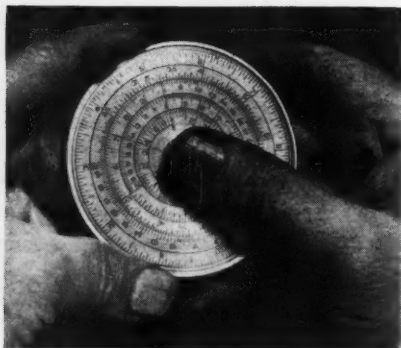
Plan to try **AIR-SAVERS** on jobs that have given you most trouble. Easily installed with simple mountings supplied—or our engineers will gladly cooperate with yours. Send the coupon.

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Send data on your **AIR-SAVER**.

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**Tasco Indestructible Circular Vest Pocket
Slide Rule**

process is claimed to provide an average accuracy within $\frac{1}{4}$ of 1 per cent, with the added advantage that the accuracy is unaffected by moisture absorption or changes in temperature. The rule is grease and water proof, and when soiled can be cleaned with soap and water. A manual giving complete instructions for use is supplied with each rule.

"Marvel" Hole Saw

Holes that are too large to be drilled with a twist drill of the ordinary type can be machined quickly and easily by the use of the "Marvel" Hole Saw, made by Armstrong-Blum Manfg. Co., 345 N. Francisco Ave., Chicago, Ill.

The saw is made from a section of high speed steel curved to form a band, as shown, and attached to an arbor which also carries a high speed drill of small diameter. The drill projects beyond the

edge of the saw so that it will start to cut before the saw enters the work and thus will serve not only to center the saw properly, but also to prevent vibration when the saw is operating.

By using this saw, holes can be cut that otherwise would require the use of a very large drill or a special boring tool, either of which would most likely have to be used in a heavy machine tool. The "Marvel" hole saw can be operated efficiently in a comparatively light drill press. The tool is accurate enough for all ordinary purposes, and has ample chip clearance for deep holes. It can be furnished in practically any size desired.



"Marvel" Hole Saw

Shaw Model E Blue Printer

The Shaw Blue Print Machine Co., 11 Campbell St., Newark, N. J. has brought out a horizontal blue print machine, designated as the Model E. The machine consists primarily of two cast end frames carrying a half cylinder of curved plate glass in which are located three General Electric Mercury Vapor Tube Lamps. A table of quartered oak is attached to the front of the machine, and an endless canvas band travels over the table and around the glass cylinder, acting as a conveyor to carry the tracings and sensitized paper around the cylinder so that the lamps can act upon the paper. Trac-



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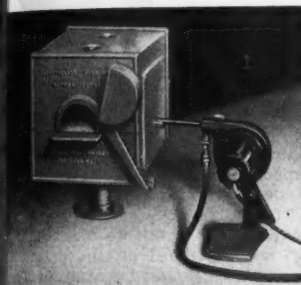
With its advanced design and precision construction, the Hjorth Bench Lathe provides many advantages to you. Many users say it is the handiest tool in the shop . . . the best money maker.

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HIGH SPEED HEAT in 20 Minutes

Operates for 7c per hour—No scaling or decarburization—No separate blower or piping expense—Burner may be used separately as a powerful bench torch—Muffle size $6\frac{1}{2} \times 3\frac{1}{2} \times 2\frac{1}{2}$. Price \$70 as shown. It will quickly save its cost. We also build a larger furnace with built-in torch, muffle opening $4\frac{1}{2} \times 3\frac{1}{2} \times 6\frac{1}{2}$ deep.

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Saves cost in sawing, filing and lapping on dies, gauges, tools, etc., up to 1" thick. In highest possible quality of material, precision of machining and nicety of adjustments, the "BUTTERFLY" Filing Machine is as painstaking a product as the finest watch movement—and just as reliable.

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Made in its entirety under the direct personal supervision and exacting standards of the well recognized and able engineer, Leonard Markels. All parts are interchangeable.

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WITTEK AUTOMATIC ROLL FEEDS and Reel Stands for Punch Presses

Fast Accurate Automatic

Wittek Feeds are designed for high-speed feeding of any stock from coils. Can be mounted on the right, left, front or back or in tandem as a push-pull feed. Will feed from 0" to 30" or more per stroke of the press. Built with or without straighteners to meet all feeding conditions.

Write for Bulletin MS and Free Trial Offer

WITTEK MFG. CO. 4305 W. 24TH PL. CHICAGO



ings up to 42 inches in width by any length can be printed.

A door in the end of the machine makes the lamps easily accessible for cleaning. The top of the machine is shielded by a hinged cover which carries, on the under side, an aluminum satin-finished reflector. The reflector serves to conserve the light from the lamps, and is so constructed that it also serves as a vent for the circulation of air in the interior of the machine.

Power to drive the canvas band is provided through a 1/6 h.p. motor which is controlled by means of a panel board type of switch box at the left side of the machine. Independent snap switches are also provided for each lamp. A variable speed control at the right side of the machine provides a speed ratio of from six inches to five lineal feet per minute.

The machine is attractively finished in Hunter's Green.



Shaw Model E Blue Printer

Truco Grinding Wheel Dresser

The illustration shows a diamond wheel dresser that is made with a set screw arrangement on the barrel of the tool which permits an angular application against the grinding wheel. This tool is called the "Truco" Dresser and is made by the Wheel Truing Tool Co., Inc., 13931 Oakland Ave., Detroit, Michigan. It is claimed by the manufacturer that the flexibility of the tool ensures the maximum of service from the diamond.



Truco Grinding Wheel Dresser

The diamond is set into a special metal that has been developed for the purpose. Added flexibility is given to the tool by a set screw arrangement on the diamond setting, permitting the turning of the diamond from time to time and thus maintaining a sharp point. The tool functions with equal efficiency in all positions and meets the requirements of a constant precision dressing tool. It is said that the design promotes a longer life of the diamond and eliminates, to a great extent, the possibility of damage to the point.

"Hold-Tite" File Handle

The drawing shows a cross section of the "Hold-Tite" file handle, made by the Bridgeport Handle Co. Inc., Stratford, Conn. The handle is made with a double insert into which the tang of the file is



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Operated

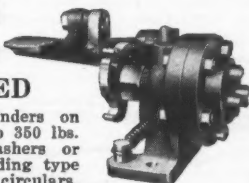
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Cored and solid. Cleaned up ends. Stock sizes, 12", 13", 14" S.A.E. No. 64. Write for folder. Buy from dealer.

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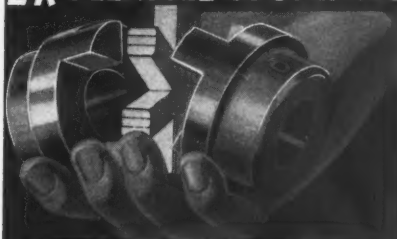
Gear Wires, Gage Blocks, Plug Gages, Microgage Lay-out Tool, Micrometer Laps, Flat Laps, Cylindrical Laps, Steel Surface Plates, Shop Triangles, Sine Bars, Light Wave Apparatus, Bench Micrometers, Flatness Testers, Deflection Bars and Special Gages.

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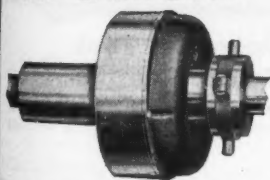
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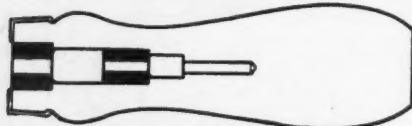
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driven. It is claimed by the manufacturer that the top insert will not loosen under any condition. The bottom insert holds



"Hold-Tite" File Handle

the end of the tang and is said to positively eliminate side sway.

The handle is made in six sizes, as follows: No. 1 size, for files 4 to 6 in. long; No. 2, 6 to 8 in.; No. 3, 8 to 10 in.; No. 4, 10 to 12 in.; No. 5, 12 to 14 in.; and No. 6, 14 to 20 in. long.

Guide For Using Frame and Power Machine Hack Saw Blades

Of all the tools used in the shop, hack saw blades are probably given the least attention. Yet a knowledge of their use will greatly increase their efficiency and each blade will more uniformly deliver the long life built into it by the manufacturer. To aid the user of hack saw blades to obtain the maximum use and wear from his blades, The Henry G. Thompson & Son Co., New Haven, Conn., has issued a "Guide for Using Hand Frame and Power Machine Hack Saw Blades". The booklet contains concise instructions, with illustrations showing how cuts should be started on different kinds of work, the kinds of blades to use for various kinds of work, the number

Did You Know That---

That the taper attachment on a lathe can be used for marking off divisions or spacing holes accurately? See page 42.

That the tool "crib" can be—and usually is—responsible for more waste in tools and time than any other department in the plant? See page 22.

That a shaper can be rigged to do a good job of profiling? See page 40.

That remote control mechanism for operating machine levers, switches, counters, valves, and other control devices can be installed easily, quickly, and economically? See page 33.

That in many plants the problem of handling and storing materials has been solved by the use of a steel bin that can be used individually or

as a part of a storage section? See page 17.

Who, in any plant, knows most about the details of the various operations, the tools and equipment, and the possible production? See page 87.

That a feed finger for screw machines is now available that can be used for either hexagon or square stock? See page 69.

That, by using a new type of rotary cutting tool, a comparatively large hole can be machined in metal with the aid of a light drill press? See page 8.

That a self-contained, easily attached, and economical automatic stop for blanking dies is now available? See page 62.

Universal Nitrided Drill Bushings Wear Longer

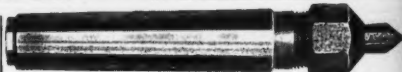


Tool life is also increased. You get Precision and Accuracy at Low Cost. Made in the A. S. A. Standard. Interchangeable with other Standard Bushings. Optional Locks and Liners.

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UNIVERSAL ENGINEERING CO.,

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Universal Tool Holder Shanks

For End Mills, Drills and Center Points. Nitrided Center Points give long life without vibration.

Power teeth the blades should have for different kinds of jobs, and so on. Copies free upon request.

The New Science of Industry

In any modern manufacturing plant where the production is of sufficient volume to warrant job planning and analysis, there is one man who knows more about the equipment, tools, and possible production than any other individual, not excepting the department foremen—that man is the time-study engineer. Time study work involves a knowledge of materials, tools, machines, power transmission, conveyors, material handling methods, and other factors of production,

and there is no better route to the "top" positions than time study and industrial engineering work.

The field for time study engineers and the qualifications necessary to success in this work are discussed in detail in a 24-page book "The New Science of Industry", which is published by the National School of Time Study, Box 366B, Norwalk, Conn. The book takes the reader step by step through the factors involved in this work, and explains how the knowledge necessary to success can be obtained through an extension study course. A copy of the book can be had by addressing the National School of Time Study at the above address.

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It pays to buy electrodes and other welding supplies from one responsible source. That is why thousands of experienced users of arc welding come to are welding headquarters for their needs—they know that Lincoln's experience gives them materials which serve them most effectively and with greatest economy.

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Ames Dial Gages: Dial gages, gage heads, cylinder gages, dial thickness gages, dial micrometers and special gages and attachments made by the B. O. Ames Company, Waltham, Mass. are described and illustrated in Catalog 50. Write for copy.

Scrapers by Power: Bearing surfaces can be scraped with a power scraper that is quicker and easier than the antique hand method. Write for information to **Amerson Bros. Mfg. Co.**, 1926 Kishwaukee St., Rockford, Ill.

Stop Tap Breakage: A booklet that tells how to stop the breakage of taps, reamers, and other tools, by the use of a friction chuck, also how to use the chuck for setting studs or nuts, has been issued by **The Apex Machine & Tool Co.**, 200 Davis Avenue, Dayton, Ohio. Sent free upon request.

A New Deal in Hack Saw Blades: "Blue End" Hack Saw Blades reduce costs by cutting faster and lasting longer. Write for data and prices to **E. C. Atkins & Co.**, 402 S. Illinois St., Indianapolis, Ind.

"Atlas" Bench Lathe: A 9-in. screw cutting, self-contained, motor-driven bench lathe is now being built by **Atlas Press Co.**, Kalamazoo, Mich. Write for circular.

"Ground-From-The-Solid" Taps: Bath taps are hardened in the solid, then the teeth are generated by grinding, producing absolutely accurate taps. Write for the "Ground Thread Handbook", free. **John Bath & Co., Inc.**, Worcester, Mass.

Drop Forged Steel Die Sets: The economy and other advantages of drop forged steel die sets, which are now being made by **E. A. Baumbach Mfg. Co.**, 1806 South Kilbourne Avenue, Chicago, Ill., are explained in a folder that can be had by addressing this firm.

Gears and Speed Reducers: Catalog No. 57, issued by the **Charles Bond Co.**, 617-A Arch St., Philadelphia, Pa., contains a wealth of information regarding gears and power transmission devices for the engineer who is concerned with the uses of gears or other forms of power transmission. Copy free upon request.

A precision micrometer, built for economy, is described in a circular that can be had by addressing **Bradley Machinery Co.**, 6502 Epworth Blvd., Detroit, Michigan.

Brighton Safety Set Screws provide an important factor of safety. No heads to project. The **Brighton Screw & Mfg. Co.**, 1450 Harrison Ave., Cincinnati, Ohio.

Stop Air-Losses and shut-downs caused by leaky air valves. Write to **Briggs & Stratton Corp.**, Dept. MS6, Milwaukee, Wis., for full information regarding the "Air-Saver".

Fine Tools of All Kinds are described and illustrated in a new catalog that has been issued by **Brown & Sharpe Mfg. Co.**, Providence, R. I. Copy free.

Buckeye Pneumatic and Electric Tools—drills, grinders, nutsetters, screwdrivers, polishers, buffers and other tools are fully described in the "Heracles" Catalog. Write for copy to **The Buckeye Portable Tool Co.**, Dayton, Ohio.

645 Stock Sizes of Bronze Bushings are listed with dimensions and prices in the **Buckeye Stock List "G"**. Write for it. **Buckeye Brass & Mfg. Co.**, 6410 Hawthorne Ave., Cleveland, Ohio.

Bushings and Bearings: 500 sizes of finished bronze bushings that are available immediately are shown in a catalog that can be had by writing to **The Bunting Brass & Bronze Co.**, Toledo, Ohio.

Carboloy Cost-Saving Tools: This booklet, issued by **Carboloy Company, Inc.**, 2485 E. Grand Blvd., Detroit, Michigan, shows a variety of types and designs of Carboloy tools which will increase production and reduce machining costs. Copy free upon request.

"Circle R" Saws for cutting metal, made in carbon and high speed steels, from $\frac{1}{4}$ in. to 14 in. in diameter, are now available. Write to **Circle Tool Co., Inc.**, 767 Allens Ave., Providence, R. I. for catalog.

Balance Your Parts the Micro-Poise Way: Vibration can be removed from flywheels, fans, wheels and other rotating parts by eliminating dynamic unbalance. Ask **Commerce Pattern Foundry Machine Co.**, 2213 Grand River Ave., Dearborn, Michigan, for full information.

Comtorplugs: Interchangeable plugs for intergaging, from 0.250 in. to 8 in. dia. and up to 24 in. in length, graduated by an amplifier 0.0001 in., are described and illustrated in a circular that has been issued by **The Comtor Company**, Waltham, Mass. Copy free upon request.

Motorize Your Cone Pulley Lathes: An attachment that can be applied to your lathe with 10 bolts makes it possible to motorize and modernize your lathes. Write for information to **Omaha Wheel Co.**, 1336 Altgeld St., Chicago, Ill.

Die Makers' Supplies: A complete line of sets, leader pins, bushings, and other die supplies are described in a book that is issued by the **Danly Machine Specialties, Inc.**, 2104 S. 52nd Avenue, Chicago, Ill. Sent free upon request.

Davis Keyseaters: The newest methods of keyseating are discussed in a bulletin that also describes and illustrates the keyseating machines made by the **Davis Keyseater Co.**, 250 Mill St., Rochester, N. Y. Copy free upon request.

Economy in Drilling Equipment: A high speed drill press, built to sell at an economical price, described in a circular that will be sent free upon application to **Delta Mfg. Co.**, 3775 N. Halsted St., Milwaukee, Wis.

Grinding Wheel Dressers: All of the different types of grinding wheel dressers made by the **Demond-Stephan Mfg. Co.**, Urbana, Ohio, including **Demond-Huntington**, **Demond-Sherman**, **Demond-Diamond-Carbo**, and diamond dressers, are described and illustrated in a catalog that has been published by the firm mentioned. Free upon request.

Alloy Tool Steels for Cutting Tools, for **Die and Parts Manufacture:** Write to **Detroit Alloy Steel Co.**, Foot of Iron St., Detroit, Michigan, for a free set of specialized literature, Series describing the uses and advantages of modern alloy tool steels.

Assemble by Power: A power screwdriver will set and screw in machine screws at a rate from 400 to 500 screws an hour is described in a folder that can be had by writing to the **Devo Power Screwdriver Co.**, 5365 Robins St., Detroit, Mich.

Steel Spacing Washers: Milling jobs can be set up quicker by using standard spacing washers made by **Detroit Stamping Co.**, 1345 West Park Street, Detroit, Michigan. Write for information.

Special Quills for Precision Grinding, made by **The Dumore Company**, 28 Sixteenth St., Racine, Wis., are described and illustrated in a booklet that can be had by addressing the firm mentioned, and similar applications are described in full in Catalog H, issued by **The Edgemont Machine Co., Inc.**, Dayton, Ohio. Copy free.

"Speed" Spot Welders for welding metals from 0.0005 in. to $\frac{1}{2}$ in. thick are described in a catalog that can be had by addressing **Elder Electric Corp.**, 781 South 13th St., Newark, N. J.

Accurately-Cut Gears of all kinds, types, and sizes can be had on short notice from **Farrington & Co., Inc.**, 381 Vulcan St., Buffalo, N. Y. Catalogs and engineering data on request, or submit your specifications for quotations.

Precision Measuring Instruments: The best types and models of dial indicators, thread test gages, pitch gages, dial comparators, and precision gages made by **Federal Products Corporation**, Providence, R. I., are described in a booklet that will be sent free upon application.

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½ to 100 K. V. A.

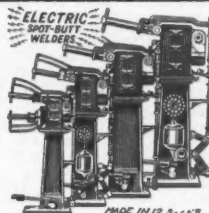
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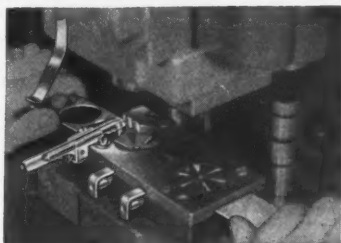
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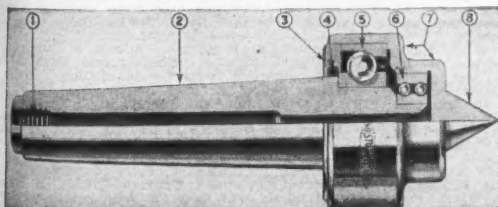
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Performance Data On Swiss Jig Bore: This 36-page pamphlet shows various types of jobs from a power shovel turntable jig to a television disc, drilled and bored on Societe Genevoise High Speed Precision Bore, giving data as to size of holes, accuracy and time savings. Free upon request to The R. Y. Ferner Co., 1008 K Street, N. W., Washington, D. C.

Ford Rotary Files. M. A. Ford Mfg. Co., Davenport, Iowa, is issuing a catalog showing, in addition to the complete line of Ford Rotary Files, illustrations of rotary files in use on various kinds of jobs. Write for copy.

Non-Chattering Piston Type Oil Relief Valves, especially suitable for use on hydraulic pumping units where specific pressure is required, are described in a folder that can be had by addressing Fulflo Specialties Co., Blanchester, Ohio.

Gairing Production Tools: The complete line of production tools made by The Gairing Tool Company, 1829 W. Lafayette Ave., Detroit, Michigan, is described and illustrated in a catalog that can be had by addressing this firm.

Special Genesee Production Tools: A bulletin issued by Genesee Manufacturing Co., Inc., Rochester, N. Y., describes and illustrates some of the special production tools made by this company. Copy free upon request.

Stampings of any kind or size can be obtained from Gerding Brothers, 5 East Third Street, Cincinnati, Ohio. Write for particulars.

Tool Chests: Fine tools should be protected against damage or theft, and the best way is to keep them in a fine tool chest. Write "Gerstner Tool Chests" 1227 Columbia St., Dayton, Ohio, for catalog of size chests.

"Tools That Go and Go" is the title of a catalog describing and illustrating the milling cutters, inserted tooth cutters, railroad work cutters, expansion reamers and mills, thread hobs, and other cutters made by Goddard & Goddard Company, 12280 Burt Road, Detroit, Mich.

3-Speed Riveters designed for high production and hard service over a long period of time are fully described in a catalog that will be sent upon request to Grant Mfg. & Machine Co., 96 Silliman Ave., Bridgeport, Conn.

Out Your Die Costs by using a continuous filing machine. Write to Grob Brothers, West Allis, Wis., for information and prices.

Ball and Roller Bearings, either journal or thrust for all purposes and all sizes, are described and illustrated in catalog No. 9 which has been issued by The Gwiliam Company, 360 Furman Street, Brooklyn, N. Y. Copy free upon request.

Variable Speed Grinding and Polishing Machines: will produce better work at lower costs. Write for catalog of polishing and grinding equipment to Hammond Machinery Builders, 1616 Douglas Ave., Kalamazoo, Mich.

Save on Die-Making Costs by using precision equipment for sawing, filing, and lapping. Ask Harvey Manig Corp., 210 Center St., New York, N. Y., for Folder No. 8.

Precision Bench Lathe Work can only be done on finely-built, accurate machines. The complete line of HJorth Precision Bench Lathes is described and illustrated in a catalog that has been issued by HJorth Lathe & Tool Company, 12 Beacon Street, Woburn, Mass. Copy free upon request.

Dermatitis infection from cutting oils—can be prevented. Write to Huntington Laboratories, Inc., Huntington, Ind., for complete information.

Oil and Waterproof Chucks: The J. & H. Electric Co., 202 Richmond Street, Providence, R. I., is now making a chuck that is oil and waterproof, and is designed to provide a maximum of holding surface with extremely strong and uniform pull throughout. Ask for complete information.

Stationary Type Tangent Dies in which the chaser holders can be changed without disassembling the die and in which adjustments can be made as fine as 0.00025 inch are now available. Write to Jones & Lamson Machine Company, Springfield, Vt., for complete details.

Diamond Tools for dressing grinding wheels can be obtained from E. Karselen, Inc., 15 West 44th St., New York, N. Y. Also dressers reset and resharpened. Write for information.

Automatic Stops for Blanking Dies, made so that they can be easily and quickly installed, are described in a circular that can be had by addressing B. Krasberg & Sons Mfg. Co., 231 Wolfram St., Chicago, Ill.

Cams—Any Style—Any Size—up to 50 inch can be had from Kur-Lonner Machine Co., 511 Lexington St., Chicago, Ill. Write for data.

Threading Machinery: Complete catalog of individual bulletins covering the pipe threading and cutting machines, bolt threading machines, or heads made by Landis Machine Co., Warminster, Penna., may be had upon request from this firm.

Weld Cast Iron: With 80 amperes D.C. welding current, solid, dense welds of greater tensile strength and ductility than the iron itself can be produced. Write to The Lincoln Electric Company, Dept. M-1, Cleveland, Ohio, for full information.

Use Steel in Coils. Coils can be handled easily and economically by the use of an automatic centering reel. Write for full particulars to F. J. Lott Machine Co., 4127 Ravenswood Ave., Chicago, Ill.

Air-Operated Work-Holding Devices: A booklet showing how air-operated chucks and devices of various kinds can be applied to different kinds of machines to save time and labor has been issued by The Logansport Machine Co., Logansport, Ind. **L-R Flexible Couplings** are simple, resilient, reversible. Only three parts. Write Logansport Works, 303 West Ohio St., Chicago, Ill., for information.

McCrosky Block Boring Bars: A new and improved method of accurately locating and locking the block in the bar provides any desired amount of float, with a new method of taking cutting thrusts. Ask McCrosky Tool Corporation, Madison, Pa., for Bulletin 12-D.

Mendes Diamond Point Angle Tools for Wheel Dressing are described in Folder "M," issued by Mendes Cutting Factories, Inc., 105 West 40th St., New York, N. Y. Copy free upon request.

Keyway-Cutting is a simple operation when the right tools are used. Write for catalog of modern keyway cutting machines to Mitts & Merrill, 1009 S. Water St., Saginaw, Mich.

"Modern" Feed Finger can be used for hex or round stock, or for hex or square stock; uses no screws, yet is so designed that the pads cannot come loose. Write to Modern Collet & Machine Co., 401 Balliolite St., Ecorse, Michigan, for full information.

Magic Chucks: Instantaneous change of tools without stopping the machine spindle can be accomplished by the use of Modern Magic Chucks made by the Modern Tool Works, Rochester, N. Y. Write for descriptive booklet.

"Practical Machinist's Guide"—A handy shop manual, containing tables of tapers, speeds and feeds, instruction for grinding twist drills, thread dimensions, tap drill sizes, and other useful information can be had by writing to Morse Twist Drill & Machine Co., Dept. 32, New Bedford, Mass. **Compound Spindle Facing Tool:** A split-facing tool containing retracting, serrated roughing cutters and fixed finishing cutters in the same tool will break up the scale easily and do accurate work. Write for bulletin to Mummert-Dixon Co., 120 Philadelphia St., Hanover, Penna.

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Time Study Work gives a man a knowledge of plant operation and manufacturing methods that can be obtained in no other manner. Write to National School of Time Study, Box 368B, Newark, Conn., for an interesting free booklet on this subject.

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Reduce Equipment Expenses: Nicholson Expanding Mandrels will save on your equipment investment and will insure a mandrel for holes of every size from $\frac{1}{8}$ in. to 7 in. Write for details to W. H. Nicholson & Co., 136 Oregon St., Wilkes-Barre, Pa.

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Ball and Roller Bearing Data Sheets: A complete set of data sheets showing all the dimensions and loads at given speeds and giving instructions for mounting precision ball bearing and Hoffmann roller bearings, can be obtained without charge by addressing the Norma-Hoffmann Bearings Corporation, Stamford, Conn.

Stamp with Numeral: The complete set of figures or letters all combined in one tool, preventing loss of single letter or digits for catalog, Numeral Stamp & Tool Co., Huguenot Park, Staten Island, N. Y.

Speed Reducers: Speed Reducers to obtain any desired reduction up to 24,000 to 1 are described and illustrated in Catalog 29 A, issued by The Ohio Gear Co., 1855 East 179th St., Cleveland, O. Copy free upon request.

Die Making Machines: How dies, templates, pages, etc., can be sawed out, filed, and lapped easily and accurately on Oliver die making machines, is fully described in a bulletin issued by the Oliver Instrument Company, 1430 Maumee Street, Adrian, Mich. Mailed upon request.

No More Out Hands caused by using files with unguarded tangs. Write to J. L. Osgood Machinery & Tool Co., Inc., 43 Pearl St., Buffalo, N. Y., for bulletin of Osgood Safety File Handles and Safety File Grips.

Save on Polishing and Buffing Operations. Ask Packer Machine Co., Meriden, Conn., for free information regarding latest types of automatic polishing equipment.

Blue-Prints Complete—printed, washed, and dried in one operation in a blue-printing machine that has a range of speed up to 12 ft. per min. Write for information to The C. F. Pease Company, 855 N. Franklin St., Chicago, Ill.

Good Gears of all kinds—spur, spiral, bevel, worm, hypoid—in fact any kind or type of gear desired, large or small, machined to an excellent finish and the highest degree of accuracy may be obtained from Perkins Machine & Gear Co., 151 Circuit Ave., Springfield, Mass. Write for estimates.

Precision Gages designed according to the most modern methods and produced by the most modern equipment are described and illustrated in a folder that will be sent upon application to Precision Gage & Tool Co., 322 East Third St., Dayton, O.

Any drill press is a tapping machine when a Procruner Tapping Attachment is used with it. Write for descriptive circular, Procruner Safety Chuck Co., 12 So. Clinton St., Chicago, Ill.

Production No. 601 Machine for sanding, surfacing, polishing, burring; leaves a straight line finish; eliminates hand labor. Write Production Machine Co., Greenfield, Mass., for illustrated folder.

Bench Lathe Mounting and Driving Equipment: Bulletin 120-A, issued by Rivett Lathe and Grinder Corporation, Brighton, Mass., contains complete descriptions and illustrations of modern and conventional countershafts, individual motor drive jack shaft, and speed box motor drive, also benches, cabinets, oil pans, etc. Copy free upon request.

Foot-Controlled Air-Valve: Air-operated equipment can now be controlled by valves that are operated by the foot, leaving the hands free to operate the machine. Write for information to the Ross Operating Valve Co., 6485 Epworth Blvd., Detroit, Michigan.

Rotor Air Tools: The latest types of air-operated hand tools for grinding, polishing, drilling, and other similar operations are described and illustrated in a 24-page book that can be had by writing The Rotor Air Tool Company, 5704 Carnegie Ave., Cleveland, Ohio.

End Your Coolant Troubles by using a Ruthman Gusher Pump. Write for information to Ruthman Machinery Co., 536 East Front St., Cincinnati, Ohio.

Out small gears, pinions, ratchets, automatically. An automatic hobbing machine for small work, with magazine feed, is described in Catalog WM1, issued by Geo. Schenck Co., 130 Lafayette St., New York, N. Y. Write for free copy.

Simonds Files: A useful book on files showing the various styles made, their uses, cross-section, and cuts, and containing a number of reference tables and other information useful in a machine shop can be had by addressing Advertising Dept., Simonds Saw & Steel Co., 470 Main Street, Fitchburg, Mass.

"Diamonds for Industrial Purposes" is the name of an interesting book on mining, grading, and use of diamonds of all kinds. Write to Anton Smith & Co., 24 State St., New York, N. Y., for a copy. **Complete Storage Units** that can be moved about individually or included in a complete bin section are described in a circular that will be sent free upon request to Stackbin Corporation, 100 St. Providence, R. I.

"High Speed Heat" in 20 minutes is available through the use of the Stark Furnace. Write to Stark Tool Co., Waltham, Mass., for information.

"The Gage of 1,000 Uses"—A conforming profile gage that can be adjusted to any contour, curve, or angle and which can be used as either gage or template for gauging or reproducing either the form or reverse of the form is fully described in a booklet that will be sent upon request to Stockton Profile Gauge Corporation, 184 Jackson St., Lowell, Mass.

The Live Center you have been Looking For The Sturdimatic Live Center has eight outstanding features; just what you have been looking for. Ask for bulletin and prices. Sturdimatic Tool Co., 5222 Third Ave., Detroit, Mich.

"Sur-Grip" Collets with Diamond Sections fully described in a folder that will be sent without charge upon application to Sur-Grip Company, 2842 W. Grand Blvd., Detroit, Mich.

"Midget" Five-In One Slide Rule is a combination of Mannheim, Polymeric, Log-Log, Binary, Add and Subtract Slide Rule. Is 4 in. diameter gives equivalent of 12-in. rule. Write to Tardis Sales Co., 21 West Broadway, New York, N. Y., for catalog and prices.

Chuck With Air: How time and labor can be saved by the use of air-operated chucks, cylinders, and other equipment is told in a book which describes "Hopkins" Air-Operated Equipment. Published by The Tomkins-Johnson Company, 620 N. Mechanic St., Jackson, Mich. Sent free upon request.

Universal Drill Bushings: Interchangeable Non-Ridged Drill Bushings, and Universal Tool Holder your production problems. Write for Data Sheet. Shanks for end mills and other tools will simplify Universal Engineering Co., Frankenmuth, Michigan. **Multiple Drilling** with a Single-Spindle Drill Methods by which multiple drilling may be done on a single-spindle drill, using multiple spindle drill heads, are discussed in a bulletin that is issued by The United States Drill Head Co., 1044 Riverside Drive, Cincinnati, Ohio.

Electrically-Driven Portable Tools: The "U. S." line of electric drills, die grinders, surface grinders, toolpost grinders, and bench and floor grinders is described in Catalog No. 33, published by The United States Electrical Tool Co., 2471 West Sixth Street, Cincinnati, Ohio. Copy free.

Accuracy to the Hundred-Thousandth can be determined by the use of Light-Wave Testing Equipment. A catalog describing light-wave microscopes, light-wave flatness testers, thread measuring wire, precision gage blocks, and other fine tools can be had by addressing The Van Keuren Co., Watertown, Mass.

"Extra Value" Hack Saw Blades: Hack saw blades made of an alloy in which molybdenum is used, and which are said to withstand shock and wear to an unusual degree are now being made by Victor Saw Works, Middletown, N. Y. Full particulars will be sent upon request.

Waltham Cylindrical Sub-Presses may be adapted for wear and perfect alignment can be maintained. Booklet on Sub-Presses and Dies can be had by addressing Waltham Machine Works, Waltham, Mass.

Toolmakers' Tool Chests: The complete line of fine tool chests for toolmakers and machinists made by J. M. Waterston, 420 Woodward Ave., Detroit, Mich., is described in Catalog No. 28. Write for it.

Expanding Mandrels Will Solve Your Problem: A set of 12 "Champion" Expanding Mandrels will fit any hole from $\frac{1}{8}$ in. to $\frac{3}{4}$ in. Write for details to The Western Tool & Mfg. Co., Springfield, Ohio.

Feed Stock from Coils at High Speed: Bulletin MS, issued by Witte Manfg. Co., 4305 W. 24th Place, Chicago, Ill., gives full details regarding the Witte Automatic Roll Feed for Punch Presses. Copy free upon request.

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